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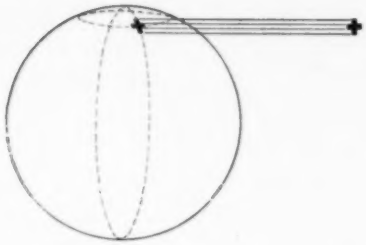
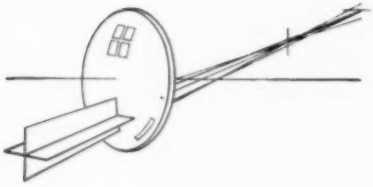


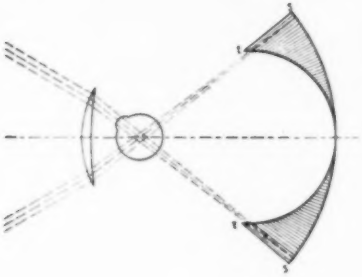
When light strikes a spherical surface obliquely, the refractive effect of the spherical surface is that of a spherocylinder. The principle is known as astigmatism.

2. PHYSIOLOGICAL FACT:



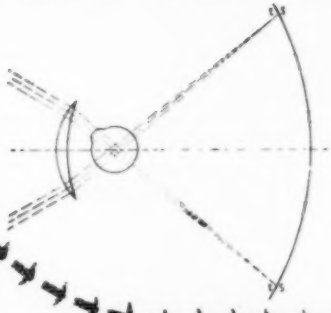
The eye can accommodate for variations in spherical power but can make no compensation for astigmatic error.

3. OPHTHALMIC PROBLEM:

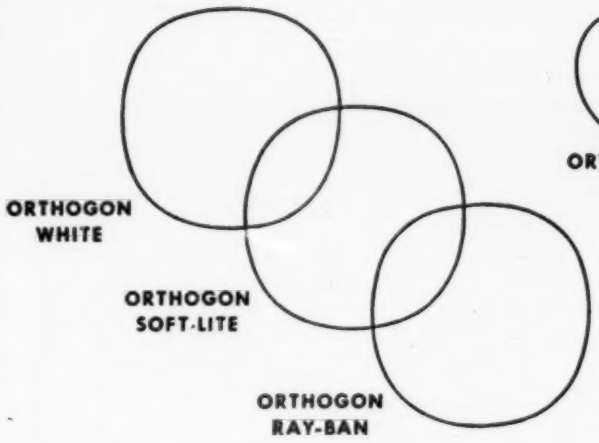


Unless there is specific correction, the image formed by any off-center portion of the lens is degraded by the astigmatic variation — for which the eye cannot compensate.

4. OPTICAL SOLUTION:



For every power of lens, from −20.00D to +7.75D, a pair of front-and-back curves can be computed, such that the astigmatic error introduced at the first surface is neutralized by an equal and opposite cylindrical effect at the second surface.



5.

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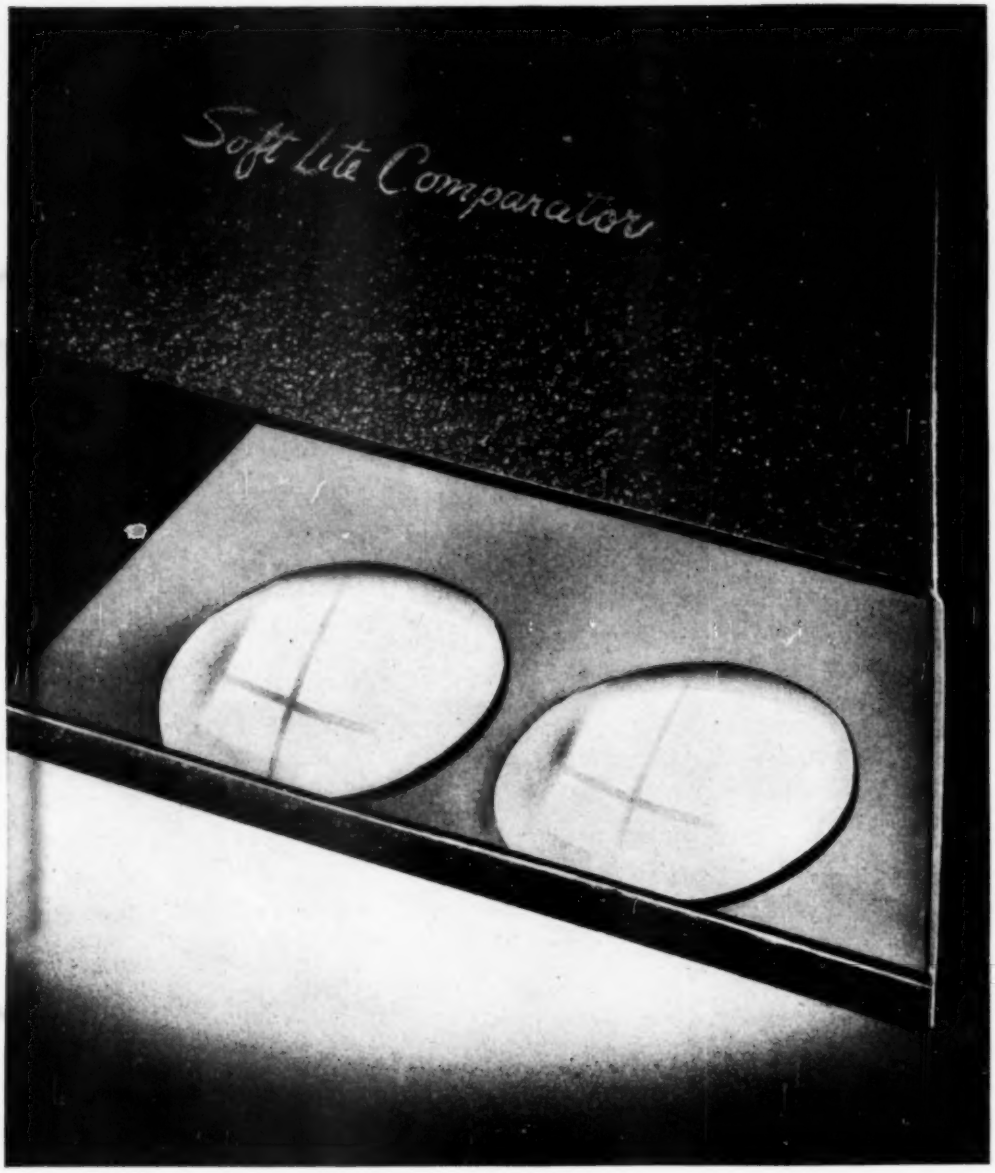

THIS IS NEUTRAL TRANSMISSION! The lens on the left is white crown glass. The other is a Soft-Lite! Notice how the Comparator demonstrates the essential similarity of transmission in Soft-Lite and white crown. Both offer natural, neutral transmission, but in different percentages of absorption. While white crown provides approximately 92% transmission, Soft-Lite is available in a choice of five degrees of absorption to suit the needs of each individual patient. Thus the question for the refractionist is not whether to prescribe neutral absorption, but rather the percentage of absorption that is required. The Soft-Lite Trial Case Accessory provides that answer.

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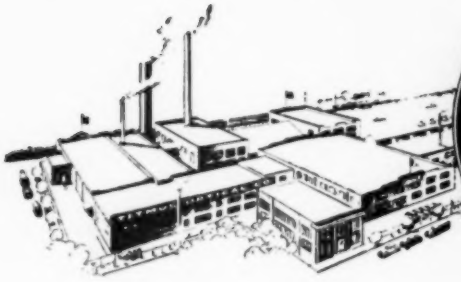

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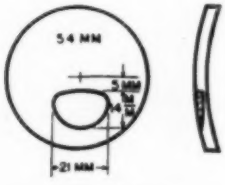

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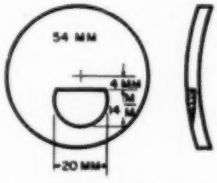

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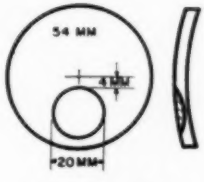

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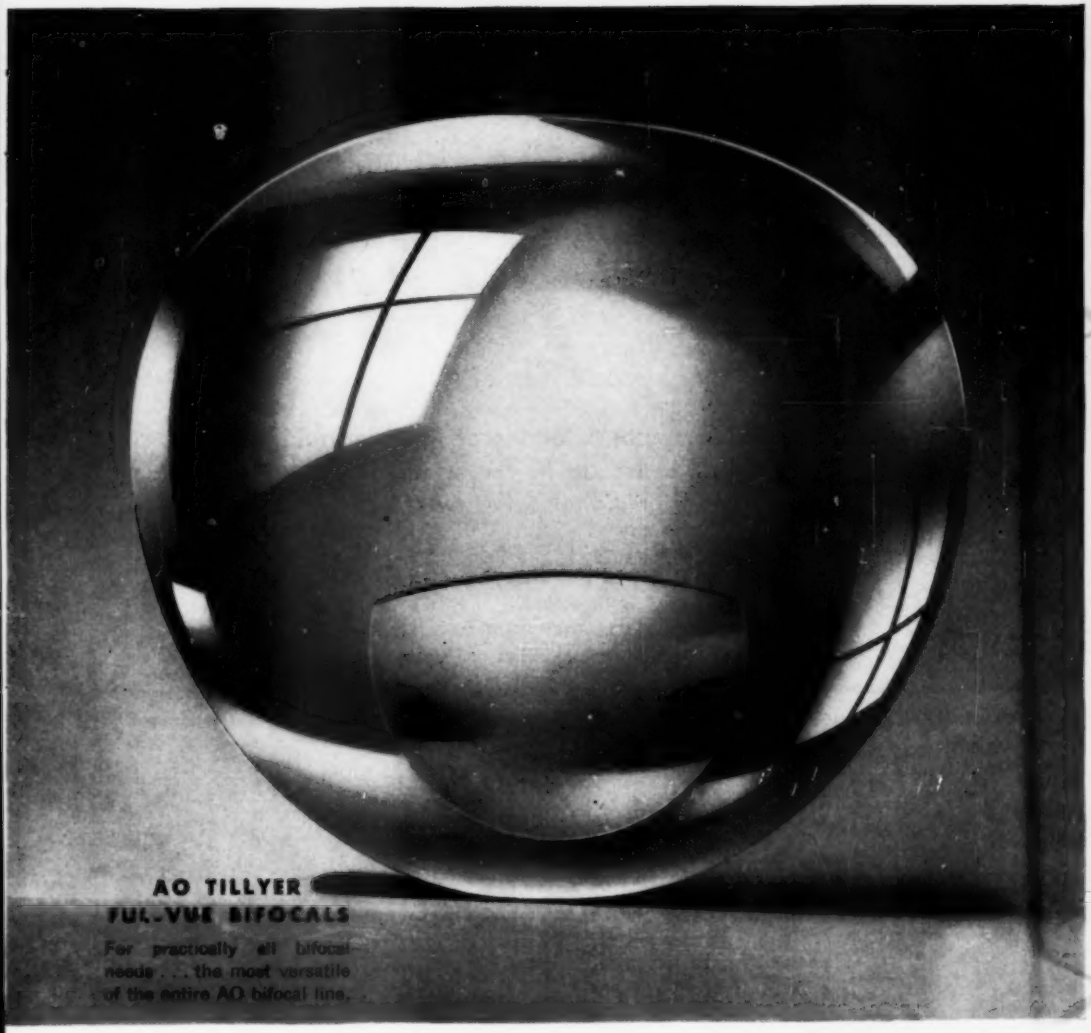

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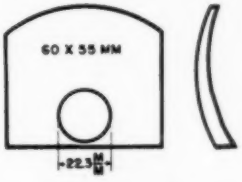

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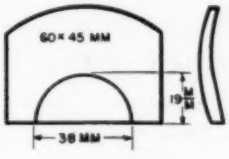

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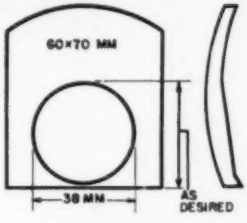

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Vol. 26 NOVEMBER, 1949 No. 11

APPLICATIONS OF PSYCHOLOGICAL PRINCIPLES IN OPTOMETRIC PRACTICE*

Alfred Lit†
School of Optometry, Columbia University
New York, New York

I presume that by now all of you are quite familiar with the nature and scope of the courses to be initiated at Columbia University this September under the new five-year program in optometry. As the person who will be responsible for developing and teaching those new courses which are related to the science of psychology, I am indeed happy at this opportunity to share my views on this subject with you this afternoon.

When the chairman of your educational committee invited me to present a paper at this convention on some aspect of psychology applicable to optometry, he suggested that I plan it as the first in a series of lectures in psychology to be continued at successive annual conventions. He believed that by this procedure a highly desired continuity in the educational programs would be obtained between one convention and the next. Furthermore, these lectures would then make available to all practicing optometrists some of the basic material contained in the new courses in psychology which are to comprise a two and one-half year sequence in the three year professional part of the optometry program.

Let us, then, follow through on this suggestion. In today's presentation I shall confine myself to a general survey of the field of psychology and shall indicate briefly how its principles and methods may be applied directly to some of the problems which you, as practicing optometrists, are likely to meet. Unfortunately, limitations in

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†Optometrist. Fellow, American Academy of Optometry. Associate in Optometry, School of Optometry, Columbia University.

time will permit only a presentation of the overall picture of the relationship existing between psychology and optometric practice. Let this lecture represent the first chapter—a table of contents, as it were—of the new courses in psychology. We shall defer for future occasions, if you should then desire it, the detailed analysis of any one of these specific aspects of psychology and its optometric applications.

The application of psychology to everyday life has become so widespread that there is hardly any human activity which has not received the attention of the psychologist. Practically every official agency or commission which is concerned with human problems has a psychologist on its staff as a consultant. The wide range of interest shown by the 6,000 psychologists who are members of the American Psychological Association[1] is indicated by the 19 autonomous divisions which constitute the Association. Each of these divisions concerns itself with a separate field of investigation, such as experimental psychology, abnormal psychology and psychotherapy, evaluation and measurement, industrial psychology, educational psychology, military psychology, childhood and adolescence, and maturity and old age.

The research activity of this small but energetic group of scientists and professional workers is unbelievably prolific. The American Psychological Association alone publishes 10 of the more than 50 scientific journals representing the various fields of psychology. Equally staggering is the number of books published in these fields. Fortunately, a considerable portion of this material is related directly to many of the problems in vision which arise in the practice of optometry. Optometry should avail itself of this material. Its application to optometric practice will serve to enhance the effectiveness of the profession in rendering its service to the public.

Certainly all of us would agree that the study of psychology—the science of behavior—should constitute an important part in the professional training of the modern optometrist. We have long recognized and appreciated the fact that psychology, hand in hand with its sister sciences, biology and physics, has contributed much to our understanding of some of the basic problems in vision. Many psychologists, as part of their interest in behavior in general, have devoted considerable attention to the study of vision. As pioneers in the field of visual research, they have provided us with some of the basic methods and techniques for the quantitative analysis of the visual functions. It is upon this firm foundation of scientific inquiry that optometry must build if it is to survive as a scientific profession and take its rightful place in the society of the learned.

The research work done in the various fields of psychology on problems related to optometric practice has become so voluminous that there immediately arises the question of establishing a basis for selecting the material most useful to students in optometry. What relative weights should be given to each of these fields, and how intensive should this training be? In seeking an answer to this question my criterion of selection has been based on three fundamental assumptions, namely, (1) *optometry is a non-medical science which is concerned with visual problems in all its aspects.* (2) *the practice of optometry will be an integral part of any comprehensive group health program which is likely to be established in the near future,* and (3) *basic research in visual science is essential for the progress of optometry and will be actively supported by the profession at large.* I should like to make each of these assumptions more explicit. The subject matter to be included in the new psychology courses will be considered in the discussion of each of these assumptions.

A primary consideration governing the selection of material for the new courses involves an analysis of what constitutes the field of optometry. In performing this analysis one must take into account not only those activities which characterize the *present* mode of professional optometric practice, but also those legally authorized activities of the *future* in which optometrists are striving to become expertly qualified. *Accordingly, my first assumption has been that modern optometry is aspiring to achieve status for its members as specialists in the science of vision.* In order to achieve this status, however, considerable training is required in the principles and methods of pure and applied psychology. The content of the new courses in psychology for the modern student of optometry has been designed to satisfy this requirement.

Contrary to popular opinion—an opinion which is, unfortunately, also shared by a large number of optometrists—the practice of optometry does not essentially consist in examining eyes or in employing an aggregate of highly specialized techniques for the purpose of obtaining eye-measurements. Strictly speaking, only the ophthalmometric, ophthalmoscopic, and possibly the retinoscopic findings represent actual data on measurements of the eyes. The rest of the examination, on the other hand, is concerned with having the patient make a visual discrimination, indicated usually by some form of verbal response to a change in the conditions of visual stimulation. The findings so obtained are known to be significantly influenced by such psychological factors as the intelligence and personality of the patient, the form and manner

in which the questions are asked, the effects of repetition or practice, and the degree to which the patient is attending to the task. If the patient is to enjoy comfortable and efficient vision, such psychological factors must be taken into account in obtaining and interpreting the optometric findings. As optometrists, you are measuring responses to visual stimulation and not merely examining eyes; you are concerned not only with the organ of vision but more so with the vision of a total organism.

To understand the *visual behavior* of an organism it is necessary to understand its *behavior in general*. For this reason it is essential that optometrists, as specialists in the science of vision, receive thorough training in the psychological principles and experimental methods employed in the study of all aspects of behavior. After all, is it not reasonable to expect that many of the characteristics of visual behavior observed in any given individual are but the manifestations of his general response pattern? Why should we not expect the "neurotic" patient, for example, also to manifest "neurotic" visual symptoms or responses?

Professor L. L. Thurstone,[2] a University of Chicago psychologist, has recently begun a research program involving the statistical study of perception based on this very principle. He employs a group of some 60 tests to obtain measures, not only of the visual perceptions, but of verbal and auditory perceptions as well. Furthermore, some of these tests also provide measures of general personality traits. The obtained scores are then statistically analyzed to determine what common factors are being measured by each of these tests. Professor Thurstone has expressed his working principle in the following terms:

> The fundamental hypothesis involved here is that the dynamics of perception, and the other restricted functions, are not isolated and that these several functions are so related that some characteristics of the person as a whole might be inferred from the dynamics of one of these functions (p. 3).

The final results obtained from such a study should be of extreme value in their application to optometric practice.

The existence of individual differences in the reactions of optometric patients is a fundamental characteristic of general behavior. No two persons respond exactly alike to the same environmental conditions. Some patients seek optometric assistance voluntarily and unquestioningly follow the professional advice given, whereas others seek aid reluctantly and reject the recommendations made. Many patients do not follow completely the professional advice rendered by their optometrists—some because of poverty or ignorance and others out of feelings of excessive vanity or anxiety or some of the other manifestations of emotional mal-

adjustment. Quite frequently you will find patients who report visual symptoms considerably more severe than those to be expected from the findings obtained in a thorough optometric examination. Conversely, in others a relatively minor lens correction, or a slight change in correction, frequently produces reductions in symptoms which are far beyond the expected effects.

The measurement of individual differences has received considerable attention from psychologists. No test of human behavior which has been devised failed to demonstrate the existence of individual differences in performance. Of special interest to optometrists are the numerous studies on individual differences in the sensitivity of the various sense modalities, including vision. The methods used and the results reported should be common knowledge to every student in optometry. The new courses in psychology will present the extensive literature on individual differences, and will emphasize especially those aspects related to the science and practice of optometry.

A second characteristic of general behavior, equal in importance to individual differences, is the variation in response of the same individual at different times under the same stimulus conditions. While the causes of individual variability are quite complex, the practicing optometrist, in obtaining data on visual performance, should be constantly aware of its manifestations. Thus, when comparisons are made between data obtained on successive examinations of a patient, the conditions of testing during both examinations should be kept constant with respect to all the factors which are known to influence the magnitude of the variability of response. Unfortunately, in most of the optometric tests used, very little is known, as yet, about which stimuli are significant in this respect and which are not. The existence of individual variability of response in optometric practice raises such vital clinical problems as: How many times must a patient be measured on any given test in order to obtain a reliable measure of his performance? How much confidence can be placed on a single measurement taken on this test? Does a given difference between the findings obtained on the same patient before and after vision training really represent a significant difference in performance, or does it merely represent the patient's day-to-day variability of response? Does practice on a given test result in greater or less variability on the part of the patient? A comprehensive research program is required to answer these important questions. As a result of extensive investigations on all aspects of individual variability psychologists have developed the experimental methods and have applied the statistical

techniques necessary for the solution of such problems. Optometry has but to apply these tools to its own advantage.

It has become a generally accepted principle that in dealing with the visual needs of patients, the practitioner is at the same time dealing with their emotional needs. The optometrist who is not aware of the emotional factors existing in his vision cases is depriving himself of a most useful diagnostic and therapeutic tool. The recognition and proper appraisal of these emotional aspects may often spell the difference between success and failure in case management. In orthoptic training, for example, the optometrist who neglects to evaluate the motivation and the inferiority feelings of the squinting child, as well as the anxiety and guilt feelings of its parents, cannot readily be expected to treat successfully the squint condition itself. The importance of such psychological factors in visual rehabilitation has been consistently reported by all workers in this field and has been most recently underlined by V. J. Ellerbrock in his report on optical aids for subnormal vision.[3]

In view of the basic principle that visual behavior can be adequately evaluated and controlled only through a knowledge of the characteristics of behavior in general, the student in optometry should receive considerable training in all aspects of the science of psychology. As a specialist in the science of vision he should be made familiar with the extensive literature pertaining to the study of all factors—both within and outside the organism—which are known to influence behavior, particularly visual behavior. Similarly, he should be aware of the various methods used to measure behavior itself. This training will require a survey of each of the special fields of psychology including comparative psychology, physiological psychology, abnormal and clinical psychology, social psychology, applied psychology and experimental psychology, in which the interests of psychology overlap those of optometry.

From *comparative psychology* the student will learn the methods used and the results obtained in the study of animal behavior. He will be introduced to the many ingenious techniques of experimental control which were especially designed for such situations in which no verbal communication exists between subject and experimenter. Data on the visual skills of all types of animals will be presented and contrasted with those found in humans.

From the field of *physiological psychology* the student will learn the relationship between an organism's physiological processes and its behavior. The nature of the physiological mechanisms underlying both

animal and human behavior will be analyzed. The influence of various drugs on visual and general behavior will be studied. Also of interest to optometrists will be the data on the influence of such physiological factors as the endocrine glands on emotional as well as on visual behavior. The student will review the experimental data on measures of the sensitivity of the various sense modalities, including pressure, pain, temperature, hearing and taste. The differences, similarities and interaction between vision and the other sense modalities will be pointed out. Of primary significance to optometrists is the study of the relationship existing between brain structure and behavior. A study of the effects of brain injuries on behavior will lead to the detailed consideration of the fascinating series of experiments on rats, conducted by Professor Lashley,[4] in which he systematically removed different parts of the brain and observed the effects produced in the various visual functions. The data he has obtained are of fundamental importance and must be accounted for in the formulation of a final theory of vision.

From *developmental psychology* the student of optometry will learn the fundamental theories of genetic development. He will review the development of human behavior patterns from embryo to old age. The comparative influence of hereditary and environmental factors on the development of these behavior patterns, particularly with respect to the visual functions, will be studied. A knowledge of the extensive work done at the Clinic of Child Development at Yale University, as reported by Dr. Gesell and his associates, will be extremely useful to an optometrist who intends working on vision problems in children.[5, 6, 7]

From *abnormal and clinical psychology* the student will learn how the principles and procedures of general psychology have been applied to the study of mental disorders. He will study the symptoms associated with each of the main functional and organic mental diseases. Considerable attention will be given to the general principles of mental hygiene and to the study of the factors which produce mental ill-health. The variety of ways in which people respond to their environment will be analyzed in terms of basic adjustment mechanisms. Typical patient behavior drawn from optometric clinical practice will be used as illustrations. The basic concepts of personality and the description of personality traits will be considered in terms of the main theories which have been proposed in the classification of "human types." The various tests of intelligence, personality, and special abilities which are generally used will be described and evaluated. The basic theories underlying each of the various techniques used in psychotherapy will be presented with special consideration being given to the theory and practice of psycho-

analysis. The concepts involved in psychosomatic medicine will be examined and the cases showing visual symptoms which have been reported in the literature will be evaluated in terms of psychoanalytic, as well as alternative, theories of behavior. The general principles and techniques which have been developed for conducting interviews or for eliciting information from patients, such as the psychiatric interview, will be analyzed as models for obtaining and evaluating optometric case histories.

From the field of *social psychology* the student in optometry will learn how behavior is influenced by social and cultural factors. Special consideration will be given to the study of the manner in which social factors, such as "attitudes," "needs," and "values," may significantly influence motivation, memory and perception. A classical illustration of the influence of "values" in visual perception is given by the results obtained in an experiment[8] in which the subjects were required to compare the relative size of ordinary postage stamps. Using stamps of the same size but of different monetary values, it was found that those which were greater in value seemed larger in size than the others. An even more striking illustration of the same effect is shown in an experiment[9] conducted on a group of rich 10 year old children and of poor 10 year old children. The children in both groups were required to compare the size of coins and identically sized cardboard discs. The results obtained in both groups showed that the coins (as objects of "social value") were judged to be larger in size than the cardboard discs. Furthermore, this overestimation in size of coins over equally sized cardboard discs was found to be greater in the case of the poor 10-year olds than for the rich 10-year olds, presumably because the coins possessed greater "value" to the poor children.

The student will investigate the experimental evidence supporting social facilitation (the improvement in performance which occurs in an individual participating as a member of a group) in order to evaluate its application to optometric practice, as illustrated by the desirability of prescribing group training rather than individual training in cases requiring orthoptics.

The extensive literature on the social adjustment of the aged and the physically handicapped should be made familiar to the student in optometry. In a recent publication of the Social Science Research Council,[10] the bibliography on vision alone contains approximately 140 references to some of the social aspects of visual disability.

From *applied psychology* the student in optometry will learn how the principles and methods of psychology have been effectively applied

to a multitude of situations involving human problems. He will be introduced to the extensive literature on visual factors in business, industry, health, education and recreation. Some of the aspects which will receive special emphasis include: the influence of the quantity and quality of illumination upon bodily and visual fatigue, the effect of motion pictures and television on vision, the influence of various visual defects on job efficiency, the influence of visual factors in reading disability, the influence of visual factors in personality and motivation, and the determination of the visual requirements in various occupations and skills. The student will be shown how the basic principles and laboratory methods of academic psychology are appropriately modified by applied psychologists to fit the given needs of a practical situation. This will be illustrated by a description of the methods used in the Aviation Psychology Program of the Army Air Forces for the classification of pilots, navigators and bombardiers. The course will describe how aviation psychologists perform a job analysis, design and administer aptitude tests based on this analysis, how they conduct research on related problems, and how the final results of the whole program are evaluated. Finally, their methods and results on studies of the visual factors in aviation will be applied to problems arising in industrial vision.

From *experimental psychology* the student in optometry will learn the various techniques used to obtain and evaluate quantitative data on behavior. He will study the basic concepts in the theory of measurement as applied to psychological data. Basic among the various techniques for measuring behavior are the so-called psychophysical methods designed to determine the minimum amount of stimulation necessary to produce a just noticeable effect *(absolute threshold)* and the minimum difference in stimulation necessary to produce a just noticeable difference in effect *(difference threshold)*. Inasmuch as the practice of optometry is concerned primarily with obtaining such threshold measurements in all types of visual functions, the student should be well informed regarding the assumptions and limitations governing each of the modified psychophysical methods employed in the routine optometric examination. A careful review of the literature on the results of psychophysical experimentation will aid the student in obtaining greater precision of measurement in optometric practice. It will also guide him in the proper evaluation of the data obtained. Special consideration will be given to a description and discussion of the methods of experimental control which are so essential for obtaining reliable and valid visual measurements. The basic concepts involved in the formulation of a scientific theory will be illustrated by some of the representa-

tive theories of visual behavior developed in psychology. The student will learn how to design experiments for the purpose of testing a theory. The various quantitative methods for analyzing experimental data will be studied in detail. In considering the many problems in vision which arise in optometric practice, the student will be encouraged to formulate these problems in terms of experimentally verifiable hypotheses. Optometric science is becoming increasingly overburdened with too many "theories" which are, as yet, either untested or, in their present formulation, untestable.

From this general survey of the specialized fields of psychology, the student in optometry will have gained a background in the principles of behavior prerequisite to proceeding with more advanced study of the visual functions in man. This advanced material will be obtained from courses in physiological optics and visual perception, in which the theory and experimental data on visual mechanisms and visual discriminations will be presented for detailed analysis. In conjunction with these lecture courses, the student will also be given an opportunity to perform experiments involving some of the basic measurements which are fundamental to the science of vision. Some of these experiments will provide data to be analyzed essentially in terms of the eye as an optical system, as in the case of the measurement of the resolving power of the eye, or the measurement of the spherical and chromatic aberration of the eye. Other experiments will provide data best analyzed in terms of photochemical theory, such as the measurement of the minimum amount of light necessary to produce a visual response *(quantal determination of vision)*, the measurement of the relative visual sensitivity to lights of various wave-lengths *(sensitivity curve)*, the measurement of the increased visual sensitivity which occurs with increased time spent in the dark *(dark adaptation)*, the measurement of the minimum difference in stimulus intensity necessary to discriminate a difference in brightness between two lights *(intensity discrimination)*, and the measurement of responses produced by intermittent luminous stimulation *(flicker)*. A third group of experiments will provide data relating to the theory of binocular space perception. Such data can be obtained from the measurement of the apparent frontal plane horopter, the measurement of depth perception, and the measurement of the distortion of visual space produced by meridional size lenses *(geometric and induced size effects)*. In a fourth series of experiments, the data obtained in measurements on color mixing and color contrast will be analyzed in terms of the theories of color vision. Experiments will also be performed which indicate the latency and persistence of the visual response following stim-

ulation by light. In a final series of experiments, the student will be concerned with data for which, as yet, no adequate theory of vision has been proposed, namely, those derived from measurements on the phi-phenomenon, the autokinetic phenomenon, size constancy, and figural after-effects.

When the student in optometry will have mastered the variety of clinical and experimental techniques employed in obtaining precise measures of the visual functions, he will have earned the right to be considered a specialist in the science of vision. In time, this recognition will be shared by both the public to whom he renders his services and the scientists in allied fields who are working on problems in vision.

Let us now consider the second assumption which has guided me in selecting the material to be included in the new courses. Briefly stated, it involves an analysis of the various group methods which have been currently proposed for ministering to the health needs of our people. *I have assumed that the practice of optometry will become an integral part of some form of medical group practice which is likely to be established in the near future—whether it be in the form of a compulsory or voluntary health program.* For this reason, it is essential that optometrists learn to cooperate with those workers in the fields of health, industry, and education who are also vitally interested in problems in vision. We must learn their aims, their special problems and their terminology if we are to contribute our own unique professional services most effectively as an important member of the "team."

Optometry, as a member of this "team," can make a real contribution in safeguarding the visual health and efficiency of our people by concerning itself with the special problems in vision which arise in the school and in industry. Only a relatively small number of optometrists can be found who are working with school authorities in an organized effort to solve some of the vision problems of the school child by conducting screening tests for the detection of the visually defective child and employing visual training in cases of strabismus, progressive myopia, reading disability, and the like. Fewer still are the number of optometrists who are similarly engaged in the solution of the many pressing problems in vision which arise in industry. As a responsible member of the "team," optometry must prove itself the best qualified group for undertaking the enormous task of caring for the visual needs arising in these two fields. Here, too, the study of psychology will serve well the optometrist who eagerly accepts these new opportunities for enhancing his specialized services to the public.

Any optometrist who intends to specialize in orthoptics or visual

training will do well to study carefully the extensive literature on the psychology of learning. He should become particularly familiar with the various theories of conditioning and learning inasmuch as the principles and methods involved in the training of visual skills are not essentially different from those involved in any other learning situation. Psychologists have already provided us with the basic methods for studying how behavior can be modified by training. They have investigated the manner in which the learning process is influenced by such factors as the type of material to be learned, the intelligence, motivation, age and sex of the learner, the amount of practice given, and the temporal factors in training. Of equal importance to the optometrist are the numerous studies which show the rate at which learning is extinguished or forgotten following the termination of practice. Also of fundamental importance in learning theory are the studies on the transfer of training. The application of the experimental results to orthoptic training should guide the optometrist in both his selection of instrumentation and his training procedures so that the patient's improvement in visual skills as measured in the orthoptics room will be most readily and effectively carried over by the patient in his everyday activities. The consideration of such matters in the new courses in psychology will better equip the student for participation in any group program concerned with the visual care of school children and industrial workers.

The third assumption which governed the selection of material for the new courses has been based on a consideration of the need for visual research in optometry. *I have assumed that optometry is eager to initiate a research program for the purpose of solving some of the basic problems in vision which arise in optometric practice and that the profession will actively support such a program.*

The personnel necessary for this research should preferably be recruited from the ranks of optometry itself. For this reason, the student in optometry should receive adequate training in statistical and experimental methods with the expectation that a larger number of our future optometrists will be encouraged to participate in this program. The basic concepts and methods of research should be made available during the early professional training in optometry. The new course in statistics and experimental methods which is to be given during the first year of the professional courses in optometry will provide the student with the necessary tools for understanding the work of scientists in allied fields who are working on visual problems.

Furthermore, as a result of this training, the practicing optometrist who is not engaged in research will be able more effectively to apply

the results of optometric research to his own practice. There will then exist a common language between the man engaged in optometric research and the man engaged in optometric practice. Each will better understand the other's problems.

This afternoon I have presented in broad outline the content of the new courses in psychology which are to be offered under the new five year program in optometry at Columbia University. I have attempted to give you a bird's-eye view of the various fields of psychology and have shown the large extent to which the interests of psychology and optometry overlap. I have tried to point out how optometrists are concerned with essentially the same principles of behavior as those which have been so extensively studied by psychologists working in these various fields. In selecting the material for the new courses, I have been principally guided by what I considered to be the professional aims, methods and interests of optometry, based on both its present and future modes of practice. The content of the new courses as here outlined must be considered as being basically provisional and tentative. The social and professional aspects of optometry are changing with such rapid acceleration that it would be highly undesirable to impose a fixed and rigid program of study at the present time. The study of the basic principles of psychology, however, will at all times find useful application in the practice of optometry. The psychological training received by the student in optometry will serve to produce a specialist in the science of vision who will be best equipped to provide for the visual care and efficiency of his fellow men.

REFERENCES

1. Wolfle, Helen M. (Ed.). *American Psychological Association, 1948 Directory.* Washington, D. C.: American Psychological Association, 1948. Pp. viii+429.
2. Thurstone, L. L. *A Factorial Study of Perception.* Chicago: University of Chicago Press, 1944. Pp. vi+148.
3. Ellerbrock, V. J. *Report on Survey of Optical Aids for Subnormal Vision.* Committee on Sensory Aids, The Office of Scientific Research and Development, 1945, 1-75.
4. Lashley, K. S. The mechanism of vision: XVII. The autonomy of the visual cortex. *J. genet. Psychol.*, 1942, *60*, 197-221.
5. Gesell, A., and Amatruda, Catherine S. *The Embryology of Behavior: The beginnings of the human mind.* New York: Harper, 1945. Pp. xix+289.
6. Gesell, A., and Associates. *The First Five Years of Life: A guide to the study of the pre-school child.* New York: Harper, 1940. Pp. xiii+393.
7. Gesell, A., Ilg, Frances L., Ames, Louise B., and Bullis, Glenna E. *The Child from Five to Ten.* New York: Harper, 1946. Pp. xii+475.
8. Ansbacher, H. Perception of number as affected by the monetary value of the objects. *Arch. Psychol.*, 1937, *No. 215*, 1-88.
9. Bruner, Jerome S., and Goodman, Cecile C. Value and need as organizing factors in perception. *J. Abn. and Soc. Psychol.*, 1947, *42*, 33-44.
10. Barker, R. G., Wright, B. A., and Gonick, M. R. Adjustment to physical handicap and illness: A survey of the social psychology of physique and disability. *Soc. Sci. Res. Coun. Bull.*, 1946, *No. 55*, Pp. xi+372.

A STATISTICAL ANALYSIS OF THE ACCOMMODATIVE-CONVERGENCE GRADIENT*

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The following investigation concerning the normal value of the accommodative-convergence gradient represents what the writer hopes is an adequate example of elementary statistical analysis which could profitably be employed to a greater extent in optometric research.

INTRODUCTION

In the field of optometry there is a procedure known both as the accommodative-convergence gradient test and as the accommodative-convergence accommodation ratio test wherein the examiner determines the effect that a change in accommodation caused by an arbitrary increase in plus lens power has upon the subject's fusional supplementary convergence or near phoria.

The technique is as follows: After determining the subject's fusional supplementary convergence with his nearpoint correction in place, while he is fixating upon a small target at 16 inches under dissociation, the lens power is increased by +1.00 D. over both eyes and the new prism power now needed to align the images is noted. This finding is then compared with the original one and when the difference in prism diopters is divided by the value of the increase in plus lens power (+1.00) the resultant fraction is known as the accommodative-convergence gradient or accommodative-convergence accommodation ratio. Because exophoric findings are conventionally expressed as minus quantities the numerator is always a negative value when the exophoria is increased (or esophoria decreased) and positive when the exophoria is decreased (or esophoria increased). As the denominator is always +1.00 under the usual conditions of the test it may conveniently be omitted and the value expressed as a simple digit. According to statistical analyses, cited by Morgan, of normal population samples this range from —4Δ ± 2Δ in 84 per cent of the cases.

The material used here represents a systematic random sampling of 100 cases selected from a universe of 700 by taking every seventh case. The original population of cases was derived from clinical data

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obtained at the Eye Refraction Clinic of the United States Naval Training Station, Newport, Rhode Island during the war.

It will be observed that, as a means of testing the reliability of the sampling, separate distributions were made of the first and second halves of the sample which were then combined for the composite picture. The mode of the first 50 cases agrees with that of the combined distribution as —3Δ while the second half shows a bimodal distribution of —2Δ and —4Δ which tends to normalize the combined pattern.

The fourth histogram illustrates the smoother and more characteristic curve which is formed when the fractional scores are eliminated by combining them proportionately with their adjacent whole scores. This provides a truer over-all picture when one considers the relative infrequency and unreliability of such fractional scores which are difficult to obtain in routine measurements on account of the technical limitations of the instruments.

PROCEDURE

1. The first step, as shown in Table I, was to select and arrange the raw scores or gradient findings in numerical order according to case number.

2. These scores were then marked on a distribution tally as in Table II and the frequency, or total number of times each score appeared, was noted. For comparison purposes the cases were divided into two equal groups and were then recombined for the total overall pattern.

3. To graph this tally data a series of charts or histograms were drawn as shown in Figures 1 to 4 inclusive. Figure 4 represents the

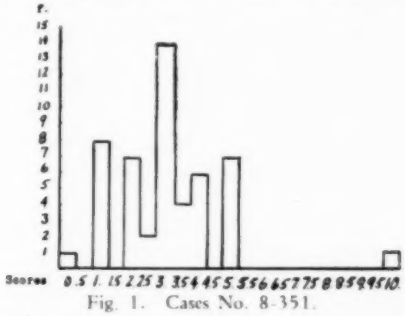

Fig. 1. Cases No. 8-351.

combined pattern with all of the fractional scores (1.5, 2.5, 3.5, and 4.5) allotted proportionately to the adjacent whole scores.

4. In the mathematical calculations as summarized in Table III the following steps were taken:

a. The scores were arranged in regular and consecutive order in the "Score" column.

b. The frequency totals or the number of times each score appeared were then arranged in the column marked "f." This is identical with the "Grand Total" column in Table II.

c. Then, to minimize the computations, a score approximately in the middle of the combined frequency distribution, namely 4.0, was arbitrarily selected as the zero point for the value " x′ " which represented the relative deviation of each score from this midpoint. Scores in excess of 4.0 were given plus values while those less than 4.0 were given minus values.

d. The "Cum. f" column was calculated by starting from the 0.0 score and adding its frequency value (f) to that of the next higher score for the latter's cumulative frequency value and so on for the entire series up to and including the score 10.0. Thus each value of the "Cum. f" series represents the total number of all the frequencies up to and including each individual score.

e. The " fx′ " column was calculated by multiplying the frequencies shown in the "f" column by the various values of x′ in the adjoining " x′ " column. This, of course, produced both plus and minus values to be added together algebraically for the total or summation of the fx′ values represented by the symbol " Σ fx′ " which happened in this case to be —176.

f. The " $(x')^2$ " column was calculated by simply squaring the values of x′ which produced a series of exclusively plus values.

g. The "$f(x')^2$" column was handled exactly like the "fx′" column except that the values for $(x')^2$ were substituted for the values of x′. This produced another series of exclusively plus values which, when added together, totalled 1,388 and were represented by the symbol " $\Sigma f(x')^2$".

m. The above data were all that were required for the determination of the statistics used in this analysis, the remaining columns being employed merely for the calculation of the proofs.

5. The *median* or midpoint score was determined by using in a formula certain data concerning the score intervals including and adjacent to the cumulative frequency point of 50. This was done as follows:

a. The score interval (i) represented the range of fractional values from one score to another and extended from one-half of a score unit (in this case .25) below the score in question to one-half of a score unit above it.

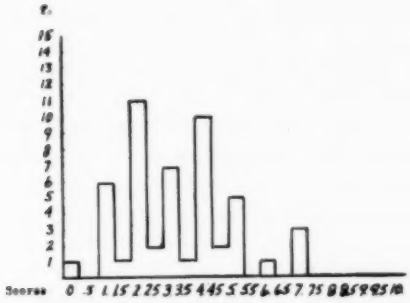

Fig. 2. Cases No. 358-701.

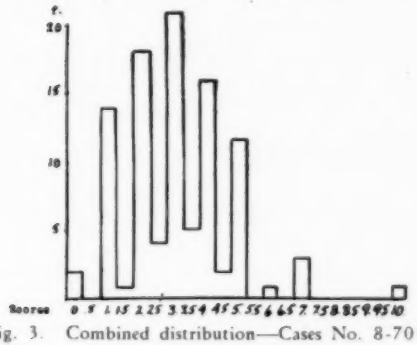

Fig. 3. Combined distribution—Cases No. 8-701.

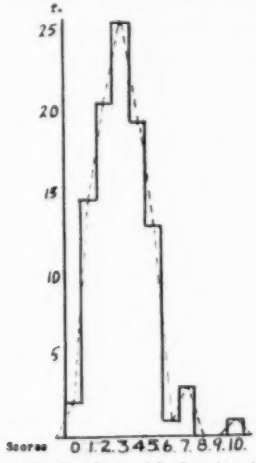

Fig. 4. Combined distribution with fractional scores integrated.

b. The two intervals used for the determination of the median were the interval from 2.75 to 3.25 containing the cumulative frequency point of 50 and called the "upper" interval and the next lower interval from 2.25 to 2.75 called the "lower" interval.

c. As there were a total (N) of 100 scores used, one-half of these equalled 50 from which was subtracted the cumulative frequency of 39 in the lower interval. This left a difference of 11.

d. To the lower limit of the upper interval was added the product of the amount of the score interval (i) multiplied by the fraction formed by the above difference of 11 divided by the number of scores (f) in the upper interval. This may be expressed symbolically and mathematically as follows:

$$\text{Lower limit of the upper interval} + i\left(\frac{\frac{N}{2} - \text{Cum. f of the lower interval}}{\text{f of the upper interval}}\right) =$$

$$2.75 + .5\left(\frac{\frac{100}{2} - 39}{21}\right) = 2.75 + \frac{5.5}{21} = 2.75 + .26 = 3.01$$

This represents the median or midpoint (fractional) score of the total distribution.

6. The *mean* or average score is somewhat easier to calculate using Table III. Here the point of arbitrary origin (A) represented the midpoint of the interval containing the score 4.0 (3.75 to 4.25) which was used as the base point or zero value for x′. By utilizing this in the formula shown below the value of 3.12 was obtained.

$$A + i\left(\frac{\Sigma fx'}{N}\right) = 4.0 + .5\left(\frac{-176}{100}\right) = 4.0 + .5\ (-1.76)$$

$$= 4.0 + (-.88) = 4.0 - .88 = 3.12$$

It will be noted that in this case the average or mean score was .11 higher than the midmost or median score.

7. The *standard deviation* or square root of the variance of the total distribution was calculated from the data in Table III via the following formula:

$$i\sqrt{\frac{\Sigma f(x')^2}{N} - \left(\frac{\Sigma fx'}{N}\right)^2} = .5\sqrt{\frac{1,388}{100} - \left(\frac{-176}{100}\right)^2} =$$

$$.5\sqrt{13.88 - (-1.76)^2} = .5\sqrt{13.88 - 3.10} = .5\sqrt{10.78} =$$

$$.5\ (3.28) = 1.64$$

This represents the amount of score difference above and below the mean which, assuming a normal distribution, should include approximately 68 per cent of the scores. However, here the distribution does not happen to be normal but instead is very peaked near the middle so that the percentage of 68 per cent is exceeded in this particular case.

8. The proofs of the computations were determined by substituting $(x' + 1)$ for x' in Table III and obtaining corresponding values for $(x' + 1)$, $f(x' + 1)$, $(x' + 1)^2$ and $f(x' + 1)^2$ that were obtained for x', fx', $(x')^2$, and $(fx')^2$ respectively. Then the totals $\Sigma f(x' + 1)$ or -76 and $\Sigma f(x' + 1)^2$ or 1,136 were employed in the following formulae:

$$\text{The mean or } \bar{X} = (A - i) + i\left(\frac{\Sigma f(x' + 1)}{N}\right) =$$

$$(4.0 - .5) + .5\left(\frac{-76}{100}\right) = 3.5 + .5\ (-.76) = 3.5 - .38 = 3.12$$

The figures used in computing the standard deviation or S are correct when:

$$\begin{aligned} \Sigma f(x' + 1)^2 &= \Sigma f(x')^2 + 2\Sigma fx' + N \\ 1{,}136 &= 1{,}388 + 2(-176) + 100 \\ &= 1{,}388 - 352 + 100 \\ &= 1{,}136 \end{aligned}$$

$$\text{The standard deviation or } S = i\sqrt{\frac{\Sigma f(x' + 1)^2}{N} - \left(\frac{\Sigma f(x' + 1)}{N}\right)^2}$$

$$= .5\sqrt{\frac{1{,}136}{100} - \left(\frac{-76}{100}\right)^2} = .5\sqrt{11.36 - (-.76)^2}$$

$$= .5\sqrt{11.36 - .58} = .5\sqrt{10.78} = .5\ (3.28) = 1.64$$

9. Comparison of the median and the mean findings were made and it was observed that the solitary "skewed" score of 10.0 was responsible in large part for the difference. Its significance in a so-called normal distribution was found via the following formula:

$$\frac{\text{Score} - \bar{X}}{S} = \frac{10 - 3.12}{1.64} = \frac{6.88}{1.64} = 4.19 \text{ units of the}$$

standard deviation from the mean. Such a deviation represents a score with less than ¼ of 1 per cent incidence when appearing on a normal curve or in a distribution of normal variance. Thus, in this study the

median score of 3.01 would be considered a more valid representation of the "practical" average and is so used in comparing it with other data.

TABLE 1: *Raw Scores*

Case No.	Score	Case No.	Score	Case No.	Score
8	3	246	4	484	1
15	2	253	5	491	0
22	1	260	3	498	4
29	3	267	3	505	4
36	3	274	3	512	7
43	3	281	4	519	6
50	3½	288	3	526	4
57	2	295	2	533	2
64	5	302	3	540	2
71	3	309	10	547	5
78	5	316	5	554	1
85	1	323	4	561	4
92	0	330	1	568	1
99	3	337	3½	575	2½
106	2	344	3½	582	2
113	4	351	1	589	7
120	1	358	2	596	1
127	5	365	5	603	3
134	1	372	3	610	3½
141	2½	379	1½	617	4
148	5	386	4½	624	1
155	5	393	7	631	2
162	3	400	5	638	4½
169	1	407	3	645	1
176	3	414	4	652	4
183	2	421	2	659	2
190	2	428	5	666	3
197	2	435	3	673	5
204	1	442	2	680	3
211	4	449	2	687	3
218	3½	456	4	694	2
225	2½	463	4	701	2½
232	3	470	2		
239	4	477	4		

DISCUSSION

It is of interest that these data which purport to show the accommodation-convergence relationship reveal a 3-to-1 instead of the 4-to-1 ratio which has been found by Morgan's investigations or the 6-to-1 ratio which is postulated by the Optometric Extension Program as a basis for the calculation of the nearpoint lags of accommodation. Although this sample is probably representative of the particular group under consideration, the latter can scarcely be taken as a typical cross-section of the patients seen in an average optometric practice because of being composed predominantly of physically fit males under 40 years of age. Such a preponderance of younger subjects may well account for the manifest discrepancy between the medium value of approximately —3Δ and the value of —4Δ which was found by Morgan although

TABLE II: *Distribution Tally*

Scores:	*Cases 8 to 351:* *Tally*	*Total*	*Cases 358 to 701:* *Tally*	*Total*	*Total Sample:* *Grand Total*
10.0	I	1		0	1+0 = 1
9.5		0		0	0
9.0		0		0	0
8.5		0		0	0
8.0		0		0	0
7.5		0		0	0
7.0		0	III	3	0+3 = 3
6.5		0		0	0
6.0		0	I	1	0+1 = 1
5.5		0		0	0
5.0	IIIII-II	7	IIIII	5	7+5 = 12
4.5		0	II	2	0+2 = 2
4.0	IIIII-I	6	IIIII-IIIII	10	6+10 = 16
3.5	IIII	4	I	1	4+1 = 5
3.0	IIIII-IIIII-IIII	14	IIIII-II	7	14+7 = 21
2.5	II	2	II	2	2+2 = 4
2.0	IIIII-II	7	IIIII-IIIII-I	11	7+11 = 18
1.5		0	I	1	0+1 = 1
1.0	IIIII-III	8	IIIII-I	6	8+6 = 14
0.5		0		0	0
0.0	I	1	I	1	1+1 = 2
Totals		50		50	100

it has been claimed that the gradient does not change with age. In any event, the results do indicate that the expected finding for this or similar tests is closer to —4Δ than to the theoretical value of —6Δ which has been so generally assumed in optometric writings.

Attention should be called to the fact that only two cases in the sample showed a zero gradient and that none showed a positive value (reduced exo or increased eso upon the addition of +1.00). In the total population of 700 cases there were only 11 with the zero value and only one with a positive ratio. This was recorded as +2Δ which from its rarity might have occurred either through faulty technique or through error in the recording of the data. Judging from this, one may well expect to find a definitely negative value in all but a relatively small proportion of the cases.

Assuming a normal distribution, the value of 1.64 for the standard deviation would appear to be rather high to correlate with Morgan's findings of ± 2Δ for 84 per cent of the cases.

SUMMARY

A systematic random sampling was made of the accommodative-convergence gradient for 100 out of a total of 700 cases taken from the records of the Eye Refraction Clinic, United States Naval Training Station, Newport, Rhode Island, during the war. Histograms were

TABLE III:

Score	f	x'	Cum. f	fx'	$(x')^2$	$f(x')^2$	$(x'+1)$	$f(x'+1)$	$(x'+1)^2$	$f(x'+1)^2$
10.0	1	12	100	12	144	144	13	13	169	169
9.5	0	11	99	0	121	0	12	0	144	0
9.0	0	10	99	0	100	0	11	0	121	0
8.5	0	9	99	0	81	0	10	0	100	0
8.0	0	8	99	0	64	0	9	0	81	0
7.5	0	7	99	0	49	0	8	0	64	0
7.0	3	6	99	18	36	108	7	21	49	147
6.5	0	5	96	0	25	0	6	0	36	0
6.0	1	4	96	4	16	16	5	5	25	25
5.5	0	3	95	0	9	0	4	0	16	0
5.0	12	2	95	24	4	48	3	36	9	108
4.5	2	1	83	2	1	2	2	4	4	8
4.0	16	0	81	0	0	0	1	16	1	16
3.5	5	—1	65	—5	1	5	0	0	0	0
* 3.0	21	—2	60	—42	4	84	—1	—21	1	21
** 2.5	4	—3	39	—12	9	36	—2	—8	4	16
2.0	18	—4	35	—72	16	288	—3	—54	9	162
1.5	1	—5	17	—5	25	25	—4	—4	16	16
1.0	14	—6	16	—84	36	504	—5	—70	25	350
0.5	0	—7	2	0	49	0	—6	0	36	0
0.0	2	—8	2	—16	64	128	—7	—14	49	98

$\Sigma fx' = -176$ $\Sigma f(x')^2 = 1.388$ $\Sigma f(x'+1) = -76$
$\Sigma f(x'+1)^2 = 1.136$
N (number of cases) = 100
i (score interval) = .5
Σ (Sigma) = "summation" or "the sum of"
* Score indicating the "upper" interval
** Score indicating the "lower" interval

made of the frequency distributions and the median and the mean scores and the standard deviation were calculated. The median, or more significant average, was found to approximate -3Δ with a standard deviation of approximately 1.64. The former is somewhat lower and the latter somewhat higher than that found in certain other studies.

BIBLIOGRAPHY

1. American Optical Company monograph. "Accommodative Convergence and Fusional Convergence." 2nd Edition. 1928. Southbridge, Mass.
2. Dvorine, I., "Theory and Practice of Analytical Refraction and Orthoptics." 2nd Edition. 1943. Waverly Press. Baltimore, Md.
3. Giles, G. H., "The Practice of Orthoptics." 1943. Hammond, Hammond & Company, Limited. London, England.
4. Hobson, J. T., "Applied Optometry." Syllabus RB. 1947. University of California Press. Berkeley, California.
5. Morgan, M. W., Jr., "Analysis of Clinical Data." The Optometric Weekly, Volume 39, No. 34, Sept. 2, 1948. Monograph No. 3. American Journal of Optometry Publishing Association. Minneapolis, Minnesota.
6. Optometric Extension Program. "Introduction to Near Point Refraction" and "Near Point Optometry" monthly papers from 1941 to date. Duncan, Oklahoma.
7. Walker, H. M., "Elementary Statistical Methods." 1943. Henry Holt and Company, New York, N. Y.

A SURVEY OF VISUAL COMPLAINTS RELATED TO TELEVISION*

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INTRODUCTION

Considerable conjecture on the viewing of television as a source of eyestrain has been precipitated by the introduction and rapid increase of popular television in the past few years. Optometrists who have received such complaints from their patients have wanted to know how prevalent such complaints are, and whether there are any symptomatic indications as to the basis for the difficulties encountered. The clinical literature as yet offers little information beyond mentioning certain visual and physical characteristics of the television picture.[1] Clinical advice to television viewers is still practically limited to popular articles in lay periodicals offering suggestions for improved and greater ease of viewing.[2,3,4,5] While there has undoubtedly been a great deal of preliminary laboratory research relating to the physical characteristics of the television picture, specific clinical research itself has been lagging. That this may be due to the lack of any well defined leads is suggested by the present survey.

The survey reported here had a very limited purpose. It was designed to determine only the prevalence of visual complaints in a large sample of optometric patients. The prevalence was evaluated in terms of certain non-optometric information such as age, sex, frequency of viewing, and the method of eliciting the complaint.

PROCEDURE

The data were obtained from 292 clinical consultations with patients receiving routine optometric examinations. About 60 per cent of the data was obtained from consultations reported by nine staff members‡ of the clinic of the Los Angeles College of Optometry, and the remaining 40 per cent was obtained by 15 optometrists§ practicing

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in Los Angeles and neighboring communities. All of the information was obtained in the same 10-day period prior to August 1, 1949. Each of the examiners was given a supply of mimeographed questionnaires to be filled out by himself after completion of the routine case history on a series of consecutive patients. The questionnaire was worded as follows:

1. Patient's name _____ Age _____ Date _____
2. Did the patient, without *specific* prompting, volunteer any comments about watching television? (Answer *yes* or *no*) _____.
3. If answer above is *yes*, did the comment indicate that watching television was in any way whatsoever related to his (or her) visual problem or complaint? (Answer *yes* or *no*) _____.
4. If the answer to No. 3 is *yes*, did the comment indicate that the patient suspected that television was to any degree or in any way the cause of his (or her) visual difficulty? (Answer *yes* or *no*) _____.
5. Now ask the patient (directly, but somewhat casually), "Do your eyes bother you when you watch television?" (State patient's answer briefly) _____
6. Now ask the patient "How much time do you spend watching television?" and classify the answer by checking one of the following:
   _____ (a) Has not seen television.
   _____ (b) Has observed television only on a very few occasions.
   _____ (c) Watches television only a couple hours a week on the average.
   _____ (d) Watches television an hour or two each day on the average.
   _____ (e) Watches television several hours almost every day.
   _____ (f) Other answer: _____
7. Now ask the patient "Is there a television set in your home?" Answer: _____
8. Examiner's comments, if any: _____
   Name of examiner _____.

All of the returned questionnaires were not usable in every respect. Examiners did not always show maximum proficiency in providing answers until they had completed two or three questionnaires. Some confessed that they would forget to fill them out for a series of several patients until a patient mentioned television. This, however, did not happen in the clinic where the examiner was systematically reminded. Also, answers to specific questions were sometimes inadvertently omitted. In a few instances the examiner could not classify an answer in terms of the limited answers allowed, and so recorded only a question mark or a statement of his difficulty.

All of the answers to question No. 5 were evaluated by the author himself in terms of *yes*, *no*, or *doubtful*. The sex was judged from the patient's first name, as the question of sex was not provided for in the questionnaire. Doubtful names were not classified.

RESULTS

Of preliminary interest is the comparison of the answers given by clinic staff members with the answers given by the practicing optometrists. Table I summarizes the answers given by the two groups.

TABLE I

"Yes" and "No" answers given to Questions 2-7 by all patients of the Clinic and all patients of private practitioners.

QUESTION	CLINIC STAFF		PRACTITIONERS	
	"YES"	"NO"	"YES"	"NO"
No. 2	2	175	28	82
No. 3	2	0	18	9
No. 4	1	1	10	8
No. 5	45	97	45	50
No. 6a	14		4	
No. 6b	124		46	
No. 6c	29		26	
No. 6d	10		23	
No. 6e	3		11	
No. 7	23	155	34	73

The pronounced difference in the ratios of "yes" and "no" responses to Question No. 2 for staff members and private practitioners is not easily explained. The fact that all of the staff examinations were second examinations, preceded by a student examination, may be a major factor. Also, the practitioners may have failed to fill out questionnaires for many not mentioning television in the routine case history. This was suggested by the fact that there was extreme variation in the per cent of "yes" and "no" answers to No. 2 between individual practitioners. It may be true also that private practitioners get a greater proportion of television-conscious patients. The answers to all of the other questions indicate more reasonable agreement between the two groups of examiners, except that the practitioners' data consistently show a noticeably greater proportion of patients identifying themselves as "television" patients. In any case it is apparent that the answers to No. 2 do not provide a very reliable index to the prevalence of visual complaints related to television viewing.

Of special interest is the statistical comparison of the "complaint" data obtained without specific prompting (Questions No. 2, 3, and 4) and the "complaint" data obtained by direct questioning (Question No. 5). Nos. 2, 3, and 4 depend on the patient's voluntary and unprompted reports on television during a routine case history. It was assumed that the examiners gave their patients ample opportunity to report their visual difficulties with a minimum of specific direction or prompting.

Altogether, 30 of the 292 patients (approximately 10 per cent) volunteered unprompted comments about watching television. The comments of 20 of these 30 patients indicated that they associated their visual problems or complaints in one way or another with television viewing. Fourteen of the 20 reported that they had television sets in

their homes: the other six did not have television sets in their homes. Eighteen of the 20 reported that they watched television regularly. Eleven of the 20 indicated that they suspected that television was to some degree the cause of their visual difficulty. The age of the patient did not seem to be a determining factor in these reports. The data on these 30 cases are tabulated in Table II.

TABLE II

"Yes" answers given to Questions 3, 4, 6 and 7 by the thirty cases providing "yes" answers to Question No. 2.

AGE	No. 2	No. 3	No. 4	No. 6b	No. 6c	No. 6d	No. 6e	No. 7
5-14	2	2	1	0	0	2	0	1
15-24	0	0	0	0	0	0	0	0
25-34	7	6	4	0	1	4	2	5
35-44	6	4	2	0	1	4	1	6
45-54	10	4	3	3	1	5	1	5
55-64	3	3	1	0	1	2	0	0
65-74	2	1	0	0	1	1	0	1
Total	30	20	11	3	5	18	4	18

A similar analysis was made of the 20 patients who supplied unprompted information that they believed that watching television was in one way or another related to their visual problems or complaints: in other words, those who provided "yes" answers for Question No. 2. Of these 20, two had observed television only on a very few occasions: the other 18 viewed television regularly. Fourteen reported television sets in their homes; the other six reported no sets in their homes.

Of the 11 patients who supplied unprompted information that they suspected that television was to some degree or in some way the cause of their visual difficulty, two had observed television only on a very few occasions and nine were regular observers. Three of the 11 did not have television sets in their homes.

A question that may be raised is whether the three groups mentioned differ in the amount of time spent at viewing television. The viewing time or the regularity and frequency of viewing is represented by their answers to Question No. 6. It also may be assumed to have some bearing on whether or not there is a television set in the home (questionnaire item No. 7). A careful inspection of the data did not reveal any significant differences in viewing habits or accessibility to television for the three groups volunteering unprompted remarks concerning television. In other words, the degree to which patients voluntarily associated these unprompted visual complaints with television did not seem to relate to the amount of time viewing it or their accessibility to television.

An analysis of the answers obtained by direct questioning of the patient provides a more reliable confirmation of this conclusion. Altogether, 90 (38 per cent) of the 237 patients whose answers to Question No. 5 could be classified unequivocally as "yes" or "no" answered "yes." Out of the whole group of 292, 30 per cent answered "yes," 49 percent answered "no," and 21 per cent provided doubtful or unrecorded answers. These percentages can be computed from the data in Table I. The data in Table III provide similar percentages, but they do not include answers by those whose ages were not recorded. Because the data from the clinic differ slightly from the data provided by private practitioners, the results may be summarized more grossly by saying that approximately one-third of the optometric patients in this study answered "yes" to the question "Do your eyes bother you when you watch television?"

TABLE III

Ratios of "Yes" to "No" answers to Question No. 5 for each category in Question No. 6.

Age	Subdivision of Question No. 6 b	c	d	e	All categories (b, c, d, & e). Per cent saying "Yes"	Regular observers only (c, d, & e). Per cent saying "Yes"
5-14	1:5	2:3	1:1	0:3	25%	30%
15-24	8:12	3:6	1:0	0:0	40%	40%
25-34	8:16	3:9	5:1	2:0	41%	50%
35-44	9:10	3:4	4:3	0:5	42%	37%
45-54	9:20	3:3	2:8	1:3	31%	30%
55-64	8:12	5:2	2:1	0:0	50%	70%
65-74	2:10	3:1	1:1	0:0	33%	67%
75-(85)	1:5	0:0	0:0	0:0	17%	-----
Total	46:90	22:28	16:15	3:11		
	34% yes	44% yes	52% yes	21% yes	37%	43%

Table III also provides an analysis of the answers in terms of age. It may be readily seen that there is no significant trend of complaints with age within the total age range represented (5 to 85). This statement is true not only for all of the patients who have ever seen television, but also for the patients who watch television regularly.

Table III also shows (in the bottom row) the relationship of the answers to No. 5 to the amount of time spent viewing television. The differences in percentages shown are not significant. There is also no consistent trend apparent. In other words, those who have seen television only on occasions show only a slightly lower ratio of complaints than those who watched television regularly. If this difference is statistically significant, one may then question the validity of the difference, since it may be assumed that those who have seen television only on a

few occasions would be more cautious in identifying it as a source of eyestrain.

Another analysis was made in terms of whether or not the presence of a television set in the home influenced the answers given to Question No. 5. This analysis was made only on those for whom age data were available and who gave unequivocal "yes" or "no" answers to No. 5. Out of 175 who did not have television sets in the home 66 (or 38 per cent) reported that their eyes bothered them when they watched television. Out of 54 who had sets in their homes, 22 (or 40 per cent) reported that their eyes bothered them when they viewed television. The difference in percentage is obviously not significant.

The same analysis showed no significant trend with age.

The sex difference in replies to No. 5 were slight but approaching significance. 35 per cent of the males (36 out of 102) and 42 per cent of the females (50 out of 120) giving unequivocal answers to No. 5 reported that their eyes bothered them when they viewed television.

So far as could be ascertained from the patients' comments, very few, if any, were refusing to accept television on the basis of suspected eyestrain. In instances where such rationalization was offered, it seemed so casual or lackadaisical as to belie the real reasons for not availing themselves of television entertainment.

In answer to Questions No. 5 and 8 considerable information was provided relative to the symptoms of eyestrain experienced. These symptoms showed no peculiar characteristics. They included lacrymation, dizziness, headache, itching, burning, sleepiness, blurring, and conjunctival hyperemia. "Yes" answers were typically emphatic.

DISCUSSION AND SUMMARY

In considering these data it must be borne in mind that optometric patients represent a sample of the population characteristically experiencing visual discomfort. Certainly a significant share of the patients come in with general visual discomfort which automatically includes discomfort during television viewing. For these patients it is only significant that they can so readily identify this visual discomfort with television viewing. Since television can be viewed under a variety of conditions of distance, brightness, contrast, duration, and posture, it represents a visual task not so discrete as other common tasks associated with eyestrain, such as sewing, driving, movies, etc. It is doubtful that any other single visual task so simply identified would elicit the percentage of complaints associated with television. It is more remarkable that the significant share of patients who come in with specific visual complaints should also include television as a source of trouble. The questionnaire did not elicit infor-

mation relative to other visual complaints, but the high percentage identifying their visual difficulties with television certainly precludes the possibility that only those with general visual complaints were involved. The absence of correlation of complaints with age and frequency or duration of viewing tends to confirm this inference. Likewise the variety of symptoms suggests that television difficulties are not readily identified with a limited category of patients.

In conclusion, it should be pointed out that this limited survey offers little to indicate whether routine optometric corrections will eliminate or reduce television complaints, or whether television viewing has any deleterious effects on vision. It only serves to indicate that patients with visual complaints readily identify their visual discomforts with television viewing.

REFERENCES

1. Murroughs, Thaddeus R., Image Definer for Television. Journal of the American Optometric Association. Vol. 20, No. 4, November 1948, pp. 271 passim.

2. How to Look at Television. Science Illustrated. Vol. 4, No. 2, July 1949, pp. 65-69.

3. Dyster, Carl, (Science Editor), No Blinders Necessary. The Mirror, Los Angeles, May 23, 1949.

4. Television and Eye Strain. Journal of the American Medical Association. Vol. 139, No. 17, April 23, 1948, p. 1237.

5. Black, S., Television Withou: Eyestrain. Vision. Vol. 3, No. 2, Summer 1949, pp. 2-3.

ABSTRACTS

ILLUMINATION AND VISUAL ACUITY. J. I. Pascal. Optometric World. 36 (9), 24-28, September 1948.

A brief account is given of the attempts to correlate the degree of illumination with the degree of visual acuity since the earliest investigations by Tobias Mayer in 1754 to the very latest work of Selig Hecht.

A. Posch postulated that visual acuity varied as the logarithm of the intensity of illumination and this has been found substantially correct for all except very high and very low illumination.

Hecht explained the relationship by postulating different thresholds for the sentient elements of the retina. As the illumination increases the elements with increasingly higher thresholds become functionally active and visual acuity rises. At a certain level of illumination all elements become active when further increase of the illumination has no effect.

The author includes some comments on the Duplicity Theory of Von Kries; the photon as a unit of retinal illumination; and the hypothetical photo-chemical substance which initiates the retinal processes.

R. E. B.

HEAD TILT IN STRABISMUS*

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In cases of strabismus, especially in cases due to paresis or paralysis of the vertical muscles, there is often a compensatory head tilt which is more or less diagnostic of the paretic muscle. The purpose of the head tilt is generally to facilitate fusion of the images. The head tilt is more common in palsies of the oblique muscles than in those of the recti muscles, but they may be seen in any case. It is very easy to relate the tilt of the head to the muscle involved by means of the two Benzene-ring muscle schema devised by the writer. Everybody knows the Benzene ring from his elementary chemistry.

In Figure 1 imagine a Benzene ring in front of each eye of the patient. Each limb of the ring represents the complete action of the muscle corresponding to the limb. There are six limbs corresponding to the six muscles. The muscles are placed on the ring as their name suggests. Thus starting with the right ring before the right eye, at the right upper limb (corner) we place the right superior rectus, at the right outer limb the right external rectus, at the right lower limb the right inferior

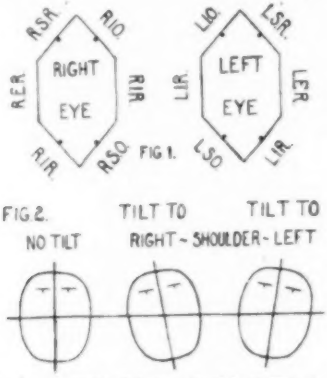

Fig. 1. (Top). Pascal's Schema for Head Tilt in Strabismus.

rectus. The obliques are opposite in their anatomy and physiology, so the superior oblique is placed at the lower inner limb, the inferior

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oblique is placed at the upper inner limb, and the rectus internus is placed at the inner limb. Similarly for the left ring before the left eye. We start at the left upper (corner) limb, with the left superior rectus, left outer limb with the left externus, the left lower limb with the left inferior rectus, the obliques on the inside, the superior oblique at the lower limb, the inferior oblique at the upper limb, and the internus at the inner limb.

The inclination of the upper and lower limbs may be considered as the inclination of the mid-vertical line of the face and head, as in Figure 2. Thus palsy of the right superior rectus, right superior oblique, left inferior oblique, and left inferior rectus, causes a head tilt to the left shoulder. Palsy of the right inferior rectus, right inferior oblique, left superior rectus and left superior oblique causes head tilt to the right shoulder. This does not have to be memorized as the tilt is read off directly from the Benzene Ring.

It must be emphasized that the tilt shown in the diagram is for the purpose of fusing the images. Occasionally the tilt is in the opposite direction for the purpose of easier suppression of the false image. The direction of tilt for suppression, for any muscle, is easily seen as it is always the opposite to that for fusion, the latter being shown by the inclination of the corresponding limb. Thus head tilt for the purpose of *suppression* in palsy of the right superior rectus will be to the right shoulder, of the right inferior oblique to the left shoulder, and so on.

SUMMARY

In palsies of the vertical muscles there is often a compensatory head tilt for the purpose of fusing the images. The direction of the head tilt is easily remembered, as it is shown by the inclination of the corresponding limb in Pascal's Benzene-ring muscle schema. For purposes of suppression the head tilt is in the opposite direction.

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OPTOMETRIC EDUCATION

Dr. Lit has submitted a paper, "Application of Psychological Principles in Optometric Practice," appearing in this issue of our Journal, which we hope will be but the first of several on this important subject. This paper introduces us to the significant contribution that various courses in psychology should make toward the education of future optometrists. It also precipitates some reflections upon the developments in optometric education since optometry's birth.

Sixty years ago, there were no institutions teaching non-medical refraction or optometry. With the advent of mass production in the optical industry in this country during the 1890's, several companies offered short courses of instruction, often completed in two weeks, in the use of their trial cases and opticians' equipment. In 1895, one of the first more "advanced" courses in refraction to which opticians were

admitted was a three-month period of instruction given by the Northern Illinois College of Ophthalmology and Otology in Chicago.

Following the passage of the New York State Optometry Law in 1908, the first course in optometry at a university was instituted in 1910 at Columbia. This was a two-year course. The first-year subjects included plane trigonometry, physics, theoretical and physiological optics, anatomy and physiology of the eye; the second-year courses consisted of physics, theoretical, practical and physiological optics, and theoretical and practical optometry. In 1915, the Needles Institute of Optometry was established in Kansas City, Mo., with a 30-week course; and the Rochester School of Optometry, with Ernest Petry as Dean, began a two-year course. Also, in 1915, a second university, Ohio State, inaugurated a four-year course in Applied Optics, with Charles Sheard as Director.

In 1926, there were 30 schools of one kind or another teaching optometry in this country, but in that year, 20 of these schools were disqualified by the International Association of Boards of Examiners in Optometry. However, by 1945, the number of accredited American optometry schools had grown to thirteen, of which four are university courses.

Optometric education has come a long way during the past sixty years: from a two-week "course" to a two-year university course, then on to three and then four-year courses. Now, many school and university courses in optometry are operating on a five-year schedule. Furthermore, there is considerable discussion of increasing the education of the optometrist even further to a six or seven-year course.

The question may be asked: "What are optometric students being taught in addition to the basic courses dealing with optics, anatomy, physiology, and clinical refraction?"

One significant addition to the optometric curriculum is the consideration of the psychological aspects of human behavior in general, and more specifically, the psychological aspects of vision. A popular misconception concerning psychology is that the purpose for its study is to enable one to foist upon his patients unnecessary treatments and/or additional pairs of glasses. One has heard the statement: "If you use the right 'psychology' you can convince the public of anything." Obviously, this is not the kind of psychology—if you can call it that—which is being taught in our optometric schools, or is it the kind any professional optometrist would want taught in our schools or would deign to use himself.

Bishop Berkely, in 1709, was one of the first to treat vision as a

phenomenon of psychological nature. In the latter part of the 19th Century, there was considerable controversy between the Nativists and the Empiricists as to the relative importance of innate and learned visual functions. In recent years, there has been an enthusiastic group in optometry which appears to believe that the anatomical-physiological factors involved in vision may be neglected, and attention given primarily to the psychological aspects of vision. Obviously, both the anatomical-physiological and the psychological aspects of vision are important. Neither should be neglected to the exclusion of the other, but both should be integrated intelligently.

The scope of psychology, like that of optometry, has been changing rapidly in the past 50 years. At the beginning of the present century, psychological studies were concerned with the sensitivity of the organism to the physical agencies affecting it. The primary object was the study of sensations by experimental methods as illustrated by the brilliant work of Hering, Hillebrand, Tschermak, etc. Gradually, in dealing with both normal and abnormal human behavior, it became apparent that sensations, as such, were not the chief objects of importance: but rather, they were emotions such as: wishes, inhibitions, anxieties, and frustrations. Freud, Adler, and Jung developed a psychology which probed the super-ego, the ego, and the id without employing experimental methods.

Psychology enlarged its scope, beginning about 25 years ago, to include intelligence testing which has been further developed into personnel testing and training, clinical psychology and vocational guidance. Many psychologists had begun to question the value of analyzing sensation and perception when the major problems of human beings seemed to be those of mental conflicts, frustrations, fears, inefficiency, and improper adjustment to the social and work-world.

However, during World War II, while psychologists were needed to handle the many problems of selection, classification, counselling and training of military personnel, there also arose a considerable demand for the experimental psychologist to deal with the problems of limitations in human sensory capacity which were involved in night vision, airplane and submarine operation, etc. Due to these needs brought about by the war, the study of man's sensory processes, including vision, was revived markedly.

It also became increasingly apparent during the war years that much more could be done for inefficient vision and uncomfortable seeing than had been recognized previously. One of the most important functions of optometric education is to teach an understanding of human

visual performance through a study of sensory processes and perception. While the emphasis of anatomical and physiological studies is upon discreet units, an additional need of optometry is to understand the behavior of the individual as a total unit. This, as pointed out in Dr. Lit's paper, the courses in psychology now being included in the optometric curriculum at Columbia will attempt to accomplish. Furthermore, the study of psychological methods will enable optometrists to evaluate not only new techniques but time-worn procedures, by developing an understanding of proper experimental methods and controls. In the relatively new field of visual training, knowledge of the learning process, maturation, motivation, and group dynamics will be valuable assets to the beginning optometrist.

It is true that optometry has pulled itself up largely by its own bootstraps in the short span of six decades. The educational training of optometrists has been more than doubled in extent during the past 30 years. This trend has been greatly encouraged by a relatively large number of practicing optometrists who have forged ahead themselves to expand constantly the field of their endeavors and services. This is, indeed, an auspicious sign of healthy professional growth. Further optometric education will more and more definitely assure the public, as well as other professions engaged in public welfare, that a group of young men and women are being trained to the extent that they may truly be called—specialists in the science of vision.

ROBERT E. BANNON.

ABSTRACTS

CORRECTION IN THE MEASUREMENT OF STRABISMUS. J. I. Pascal. New York. Optometric World. 35 (8) 21-22. August 1947.

The only practically important angle in visual optics is the Angle Kappa formed by the visual axis determined subjectively and the pupillary axis determined objectively by the position of the light reflex in the center of the pupil. The angle is positive when the examiner has to move temporally along perimeter to locate the light reflex in the pupil center. It is negative when he has to move nasally. A memory aid is the letter "p" temple-positive, and the letter "n", nasal-negative.

The true angle of strabismus can be obtained from the apparent angle as measured on the perimeter by the addition or subtraction of the angle kappa. A memory aid for this is to regard the squint angle in convergent strabismus as a positive angle, convergence being a positive function and the angle of squint in divergent strabismus as a negative angle, divergence being regarded as a negative function often referred to as negative convergence. The apparent squint angle and the angle kappa are then simply added with their proper signs to give the true angle.

R. E. B.

TRANSACTIONS OF THE AMERICAN ACADEMY OF OPTOMETRY

A department devoted to announcements, reports, appointments, organization data, news, professional problems and ideals, as these relate to the Academy.

THE PROGRAM FOR CLEVELAND MEETING OF ACADEMY

The Papers and Program Committee of the American Academy of Optometry presents the following program for the annual meeting of the Academy, Hotel Hollenden, Cleveland, Ohio, December 10-13, 1949.

SATURDAY, DECEMBER 10, 1949

9:00-10:00 A.M. — Registration

10:00-11:00 — Business Session

Reports by officers and committee chairmen.

11:00 — Pathology Section

"Geriatrics and Optometry," Ralph E. Wick, O.D., Rapid City, South Dakota.

"Foreign Bodies in the Cornea and Their Histopathological Significance," W. O. Vivian, O.D., Media, Pennsylvania.

Noon — Lunch

1:30 P.M. — Lecture

"The A. M. A. Method of Appraisal of Visual Efficiency," Henry W. Hofstetter, Ph.D., Los Angeles College of Optometry, Los Angeles, California.

2:10 P.M. — Lecture

"The Effect of Ultra-violet on the Human Eye," Paul Boeder, Ph.D., American Optical Company, Southbridge, Massachusetts.

2:50 P.M. — Lecture

"Near Point Test Cards," Rudolph H. Ehrenberg, O.D., Granite Falls, Minnesota.

3:30 P.M. — Lecture

"Some Approaches to the Problems of Binocular Vision," Kenneth N. Ogle, Ph.D., and Charles Sheard, Ph.D., Mayo Clinic, Rochester, Minnesota.

4:10 P.M. — Lecture

"Factors Contributing to the Stray Light in the Eye," Glenn A. Fry, Ph.D., School of Optometry, The Ohio State University, Columbus, Ohio.

4:50 P.M. — Lecture

"The Functions, Purposes, and Operation of the American Board of Opticianry," Charles Sheard, Ph.D., Mayo Clinic, Rochester, Minnesota.

6:00 P.M. — Dinner

7:30 P.M. — Lecture

"The Haidinger Brushes," E. J. Gording, O.D., Windber, Pennsylvania.

8:10 P.M. — Lecture

"Progress Report on Plastic Ophthalmic Lenses," Roy Marks, O.D., Lansing Associates, New York, New York.

8:50 P.M. — Lecture

"The Time Characteristics of the Ciliary Muscle Responses of Animal Eye to Electrical Stimulation," Merrill J. Allen, Ph.D., School of Optometry, The Ohio State University, Columbus, Ohio.

SUNDAY, DECEMBER 11, 1949

9:00-11:00 A.M. ..... Section Meetings
Aniseikonia, Contact Lenses and Orthoptics.*

11:00 A.M. ..... Pathology Section
"Diagnostic Signs of Chronic Glaucoma." Isadore Kaplan, M.D., Pennsylvania State College of Optometry, Philadelphia, Pennsylvania.

Noon ..... Lunch

1:30 P.M. ..... Lecture
"Tonicity Induced by Fusional Movements." Vincent J. Ellerbrock, Ph.D., School of Optometry, The Ohio State University, Columbus, Ohio.

2:10 P.M. ..... Lecture
"The Magnitude of the Pulfrich Stereophenomenon as a Function of Distance of Observation. A Preliminary Report." Alfred Lit, Ph.D., and Aaron Hyman, M.A., School of Optometry, Columbia University, New York, New York.

2:50 P.M. ..... Lecture
"Some Relations Between Optical Resolution and Response." S. Howard Bartley, Ph.D., Michigan State College, East Lansing, Michigan.

3:30 P.M. ..... Lecture
"Refractive Changes in the Eye Over a Period of Years." William G. Walton, Jr., O.D., Pennsylvania State College of Optometry, Philadelphia, Pennsylvania.

4:15 P.M. ..... Business Session

6:00 P.M. ..... Annual Formal Banquet
Speakers: Harold Simmerman, O.D., Vice President, Woodbury, New Jersey; Julius Neumueller, O.D., Haddonfield, New Jersey; Edward Bind, O.D., Toronto, Canada. "The Last Voyage of the R. M. S. Mascopic."

MONDAY, DECEMBER 12, 1949

9:00-11:00 A.M. ..... Section Meetings

11:00 A.M. ..... Pathology Section
"Corneal Lesions." Roscoe J. Kennedy, M.D., Cleveland, Ohio.

11:45 A.M. ..... Lunch

1:00 P.M. ..... Buses leave for Nela Park

1:50 P.M. ..... Arrive General Electric Company Research Laboratories, Nela Park

2:00-5:15 P.M. ..... Lectures and Lighting Demonstrations

2:00 P.M.	Welcome—Matthew Luckiesh, D.Sc.
2:15	G. E. Light Institute and Nela Park—L. C. Kent.
2:30	Light, Vision and Seeing—S. A. Guth and A. A. Eastman.
3:00	School Lighting—J. M. Ketch.
3:30	Office Lighting—R. L. Oetting.
4:00	Industrial Lighting—C. E. Egeler.
4:30	Horizon House—Aileen Page.

5:15 P.M. ..... Refreshments

6:15 P.M. ..... Dinner at Nela Park
Banquet Speaker: Matthew Luckiesh, D.Sc.

8:15 P.M. ..... Lecture
"New Horizons of Lamp Research," Alston Rodgers.

9:30 P.M. ..... Buses leave for Hotel Hollenden

*Programs for the section meetings will be distributed in Cleveland.

TUESDAY, DECEMBER 13, 1949

9:00-11:00 A.M.	Section Meetings
	Aniseikonia, Contact Lenses, Orthoptics
11:00 A.M.	Pathology Section
	"Some Clinical Aspects of Retrolental Fibroplasia." Irving I. Vics, O.D., Albany, New York.
	"Visual Findings in a Case of Early Multiple Sclerosis." E. Craig Wilson, O.D., Rutland, Vermont.
Noon	Lunch
	(Special luncheon for chapters)
1:30 P.M.	Lecture
	"The Relation of Visual Acuity to Age," Fred W. Job, B.S., Bausch & Lomb Optical Company, Rochester, New York.
2:10 P.M.	Lecture
	"Objective and Subjective Measures of, and Effects of Dark Adaptation on, Night Myopia's Preliminary Experiments." E. J. B. Schoen, Ph.D., Chicago College of Optometry, Chicago, Illinois.
2:50 P.M.	Lecture
	"The Zone of Clear Single Vision at the Upper Levels of Accommodation and Convergence." Mathew Alpern, M.A., School of Optometry, The Ohio State University, Columbus, Ohio.
3:30 P.M.	Lecture
	"The Effect of Low Levels of Illumination and Freedom from Optical Stimulation of Accommodation Upon the Refractive State of the Eye." Henry A. Knoll, Ph.D., The Ohio State University, Columbus, Ohio.
4:10 P.M.	Lecture
	"The Control of Occipital Brain-Wave Frequencies by Means of Flashing Light Stimuli." George W. Knox, M.A., The Ohio State University, Columbus, Ohio.
4:50 P.M.	Lecture
	"Optometric Difficulties in the Arctic." Edward P. Bind, O.D., Toronto, Canada.
6:00 P.M.	Closing Session

The Executive Council and the Committee on Admittance will conduct sessions at Cleveland, December 8-9. Applicants who have been instructed to be present should report to the Committee on Admittance, Dr. Arthur P. Wheelock, Chairman, on December 8-9 to take their clinical and written examinations.

The Examiners who will certify contact lens diplomates will also be in session for the Contact Lens Section.

CALIFORNIA CHAPTER HEARS HIRSCH

Fellows of the Southern California chapter of the Academy heard Dr. Monroe Hirsch discuss recent developments in myopia research, at their October meeting. Dr. Hirsch is a former assistant professor of physiology at Stanford University, and now on the faculty of the Los Angeles College of Optometry.

ARKANSAS CHAPTER DISCUSSES HEALTH CARE

The Arkansas Chapter of the Academy met recently in Little Rock to hear Dr. Irving P. Filderman of Memphis, Tennessee, speak on national health care. A short business meeting followed the talk.

INDIANA CHAPTER MEETS AT PURDUE

Indiana Academy Fellows met at Purdue University in October to hear staff members of the Purdue reading clinic discuss visual problems of reading.

ACADEMY POLL ON COMPULSORY HEALTH INSURANCE

In a recent poll, Academy members upheld the Executive Council's opposition to the Ewing compulsory health insurance bill before Congress, by a vote of seven to one.

The poll was made by ballot in September. Slightly over 500 ballots were mailed. The ballot read as follows:

> At Winston-Salem, December, 1948, the Executive Council of the American Academy of Optometry went on record opposing the plan for compulsory health insurance as proposed by Oscar Ewing, federal security administrator. The Council reaffirmed its position in July, 1949. Should the Academy policy against compulsory health insurance be continued. Yes ( ) No ( ).

The return was as follows: 176 affirmative votes, 25 negative votes, and two ballots returned unmarked. The return represented approximately 40 per cent of the regular members of the Academy. Ballots were not sent to chapter members or individual applicants who had not as yet completed their work to become Fellows of the Academy.

ABSTRACTS

ON NEGATIVE ACCOMMODATION. J. I. Pascal. New York. Optometric World. 36 (12). 25-26. December 1948.

Anatomical, physiological and pharmacological studies relative to the ciliary muscle suggest that there is some negative accommodation in addition to the generally recognized positive accommodation.

The refractive power of the crystalline lens in the static condition is determined by the balance between the two opposing tonic innervations. However, the existence of negative accommodation cannot explain a case reported where a patient showed 1.25 D. of myopia under non-cycloplegic refraction and 3 D. of myopia under cycloplegic refraction.

The explanation offered in the report that the homatropine must have paralyzed the negative accommodation is not as acceptable, as is the explanation that the positive aberration of the eye under a markedly dilated pupil increased the total refractive power of the eye by 1.75 D. According to the author, this may also explain the so-called night myopia of 1.00 to 2.00 diopters.

R. E. B.

SPECIAL REPORT

ANISEIKONIC FORUM REVIEWS POLICIES*

Robert E. Bannon†
School of Optometry, Columbia University,
New York, New York

Since the closing of the Dartmouth Eye Institute in Hanover, New Hampshire, there have been numerous inquiries which indicate the need for clarification as to: (1) the disposition of the Institute's research facilities, (2) the custodianship of the patients' records, and (3) the continuance of the clinical work in aniseikonia.

The Aniseikonic Forum[1] replies to the questions as follows:

(1) The research equipment of the Dartmouth Eye Institute was given in part to the Mayo Foundation, Rochester, Minnesota, and to Columbia University, New York City, with the understanding that these institutions were interested in continuing research investigations and teaching in physiological optics.

(2) The files of the Dartmouth Eye Institute patients' records were given into the custody of the Dartmouth Medical School, Hanover, New Hampshire, where they are available for purpose of providing transcripts to professional practitioners upon request by any former patient. No private practitioner or institution has been given permission to solicit the former patients of the Dartmouth Eye Institute nor to profess in any way the continuance of the Dartmouth Eye Institute.

(3) Those practitioners who are prepared to give aniseikonic examinations are listed in the following Directory of Aniseikonic Practitioners.

*Submitted on September 1, 1949, for publication in the November, 1949, issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.

†Optometrist. Fellow, American Academy of Optometry. Member of faculty. Secretary-Treasurer, Aniseikonic Forum.

[1]Editor's note: The Aniseikonic Forum, organized by former staff members of the Dartmouth Eye Institute and others interested in the correction of aniseikonia has received many inquiries about the Institute since its closing in 1947. The present report answers the questions most frequently asked.

GEOGRAPHICAL DIRECTORY OF ANISEIKONIC PRACTITIONERS

Members of the Aniseikonic Forum in the United States and Canada according to States and Provinces

ARIZONA

F. H. Pilcher, O.D.
8 West Adams St. Phoenix.

CALIFORNIA

Kenneth C. Brandenburg, M.D.
110 Pine Ave., Long Beach.

Avery M. Hicks, M.D.
490 Post St., San Francisco.

Los Angeles School of Optometry
950 West Jefferson Blvd., Los Angeles.

Michel Loutfallah, M.D.
1826 State St., Santa Barbara.

School of Optometry
University of California, Berkeley.

Arene T. Wray, O.D.
3261 West 6th St., Los Angeles.

COLORADO

Aniseikonic Clinic
Glockner Sanatorium & Hospital, Colorado Springs.

CONNECTICUT

Henry L. Birge, M.D.
179 Allyn St., Hartford.

DISTRICT OF COLUMBIA

The George Washington University Hospital
23rd and Pennsylvania Ave. N. W., **Ernest Sheppard, M.D.**, Supervisor, Washington.

ILLINOIS

Northern Illinois College of Optometry
Drexel Blvd. at 42nd Place, Chicago.

Northwestern University Medical School
Department of Ophthalmology
303 East Chicago Ave., Chicago.

KANSAS

John A. Billingsley, M.D.
University of Kansas Hospital, Kansas City.

MASSACHUSETTS

Leo F. Madigan, O.D.
59 Temple Place, Boston.

O. L. McCulloch, O.D.
Hadley Falls Trust Bldg., Holyoke.

Massachusetts Eye & Ear Infirmary
243 Charles St., Boston.

MISSOURI

Washington University Medical School
Lawrence T. Post, M.D.
640 South Kingshighway, St. Louis.

NEW HAMPSHIRE

Robert E. Bannon, O.D.
46 Lebanon St., Hanover.

Wendell Triller, O.D.
Davison Bldg., Hanover.

NEW JERSEY

Julius F. Neumueller, O.D.
320 Rhoads Ave., Haddonfield.

NEW YORK

Conrad Berens, M.D.
708 Park Ave., New York.

Columbia Presbyterian Medical Center
Institute of Ophthalmology
635 West 165th St., New York.

Harold M. Fisher, O.D.
7 Park Ave., New York.

Manhattan Eye, Ear & Throat Hospital
Aniseikonic Department
210 East 64th St., New York.

New York Eye & Ear Infirmary
Aniseikonic Department
218 Second Ave., New York.

School of Optometry
Columbia University
433 West 123rd St., New York.

OHIO

Donald G. Allen, M.D.
1021 Prospect Ave., Cleveland.

PENNSYLVANIA

H. Ward Ewalt, Jr., O.D.
8001 Jenkins Arcade Block, Pittsburgh.

B. C. Freeman, O.D.
911 Hamilton St., Allentown.

TENNESSEE

William F. Davis, O.D.
720 Exchange Bldg., Memphis.

ONTARIO, CANADA

College of Optometry of Ontario
140 St. George St., Toronto.

This Directory has been prepared by the ANISEIKONIC FORUM, office of the Secretary-Treasurer—School of Optometry, Columbia University, 433 West 123rd St., New York 27, New York.

CURRENT COMMENTS

Virginia Huck
Editorial Assistant

Optometrists will confer a favor by sending news items of general interest for this department; such as relate to new instruments, clinical techniques, education, visual health and optometric legislation and organization.

ACADEMY OFFERS FUNDS FOR RESEARCH

Dr. Meredith W. Morgan, Jr., chairman of the research projects committee of the American Academy of Optometry, has announced that applications will now be accepted for research funds for 1950. The funds, according to Dr. Morgan, will be available either as a grant-in-aid for a specific project or for the establishment of a research fellowship.

The information necessary to the Academy for consideration of an application is as follows: the nature of the proposed investigation, the approximate cost, the use to be made of the Academy funds, and the name of the director of the investigation.

Dr. Morgan explained that as a rule, projects are to be completed within one year, but that this is not an inflexible rule. Applications, he said, will be judged by the research projects committee in the order received. Each application will be considered on its own merits and not in comparison with other projects.

The only restriction placed on the investigation is that the report of the results shall be submitted for publication to the *American Journal of Optometry and Archives of the American Academy of Optometry* before being released for publication in any other periodical.

The amount to be made available will be determined at the annual meeting of the Academy in Cleveland next month.

Schools or individuals interested in applying should write to Dr. Morgan, School of Optometry, University of California, Berkeley, California.

A. S. A. TO STANDARDIZE INDUSTRIAL HYGIENE PRACTICES

Efforts to standardize industrial hygiene practices in the United States will soon be made by the American Standards Association. At its recent annual meeting in New York, the Safety Code Correlating Committee voted to organize a project to prepare a coordinated standard guide to good practice in industrial hygiene, with the purpose of protecting the health of industrial workmen. Officials from both private industry and government concerned with the health of workers were asked to work on the project.

MEETINGS, PAST AND FUTURE

Members of the Manitoba Optometric Society got together with the South West Manitoba Society on November 5 in Brandon at the Prince Edward Hotel.

* * *

The Better Vision Institute, Inc., held its third quarterly meeting for 1949 in New York City in October. Officers of the institute discussed a new BVI radio series, "The Wonderland of Vision," and the BVI program for public relations during the coming months. Mr. Leslie Myers of the N. P. Benson Optical Company presented a paper in which he recommended that optometrists and ophthalmologists be encouraged to write prescriptions for all of the jobs to which the eyes of their patients are subjected.

* * *

Southern industrialists and vision specialists met on the Georgia Tech campus in Atlanta November 6-8 for the annual Southeastern Industrial Vision Congress. Among the speakers were Dr. Matthew Luckiesh, General Electric Company, and Dr. Wayne Breck, Greenville, South Carolina optometrist.

* * *

German optometrists held their first congress since 1938 in September, in Berlin. The newly organized *Deutschen Optometristen-Gesellschaft* met in the Technical University in Charlottenburg to hear technical papers, discuss mutual post-war problems of the profession and renew acquaintances. The meeting was covered by Mr. C. S. Flick for the British magazine, *The Optician*. In his articles,[1] Mr. Flick reports not only the events of the congress, but also on post-war optics in Germany. He points out, for one thing, that optometrists are short of equipment, especially ophthalmoscopes, and lack sufficient textbooks on ophthalmic optics. This report is recommended reading for any one interested in catching up on the present situation in Germany in all phases of optometry.

* * *

The Missouri Valley Optometric Society will sponsor an optometric-educator institute next Spring, according to Dr. J. H. Robinson, chairman of the society's committee on intra-professional relations. Dr. Emmett A. Betts, Director of the Reading Clinic of Temple University,

[1] C. S. Flick. *The Optician*. The organ of the British optical profession. Vol. CX VIII. No. 3053. October 7, 1949. p. 281. Vol. CX VIII. No. 3054. October 14, 1949. p. 309.

will be the principal speaker. The meeting is scheduled for April 1-2, 1950, in Sioux City, Iowa.

OPTICIANRY BOARD TO HOLD EXAMINATIONS

The American Board of Opticianry will examine candidates who wish to be certified as an Associate in Ophthalmic Optics in Chicago, Illinois, on February 10, 1950, according to Dr. Charles Sheard, Board President. The examinations will be both written and oral and will cover (1) theoretical mathematical, physical and optical principles; (2) laboratory or practical applications of theory, and (3) special topics.

Candidates who wish to take the examinations must meet the collegiate educational qualifications as approved by the Board. Any persons desirous of taking these examinations should apply to Mr. H. G. Wright, Executive Secretary of the American Board of Opticianry, 222 West Adams Street, Chicago 6, Illinois, not later than February 1, 1950, for the necessary application blanks, and other essential information.

READING CLINIC SET FOR JANUARY

The seventh annual reading clinic of Temple University will be held January 30—February 3, 1950, according to Dr. Emmet A. Betts, director of the clinic.

During the 1950 institute eight topics will be presented: (1) differentiated guidance in reading, (2) the language arts approach to reading, (3) vocabulary development: word analysis and semantic analysis, (4) directed reading activities, (5) development of versatility in skimming, rapid reading, and study-type reading, (6) development of assimilative and critical reading abilities, (7) materials of reading instruction, and (8) corrective and remedial procedures.

This meeting is the first in another regular three-year series of institutes sponsored by the Department of Psychology of Temple University. In 1951 the program will emphasize, "Systematic Sequences for Reading Instruction;" in 1952, "Prevention and Correction of Reading Difficulties."

Enrollment is limited by advance registration. Further information, and a copy of the program may be obtained from Dr. Betts, Director, Reading Clinic, Temple University, Philadelphia 22, Pennsylvania.

NEWS BRIEFS

At the end of the first year of operation of Britain's National Health Service scheme, there were 963 ophthalmic medical practitioners enrolled, 5,662 optometrists, and 577 dispensing opticians. The num-

ber of people who have joined a doctor's list totals 41,200,000 (95 per cent of the population). More than five million spectacles were supplied and paid for: three million spectacles are still on order. The present rate of production of spectacles is seven million a year. . . . Shuron Optical Company's 10,000,000th Shurset rimless mounting came off the assembly line of the company's Rochester plant October 24th. This figure represents 10 years of production, Shurset having been introduced in 1939. . . . Still high in popularity among optometrists is the Wick folder on eye care recently made available through the Precision-Cosmet Company of Minneapolis. Practitioners find this well illustrated little pamphlet full of timely advice for patients on illumination, reading position, eye protection, care of glasses. The brochure was prepared by Dr. Ralph Wick of Rapid City, South Dakota. . . . On November 3rd, Bausch & Lomb Optical Company entered its 96th year of operation. When the company first opened a small optical shop in Rochester, only a few thermometers, field glasses, magnifiers and horn-rimmed spectacles were on sale. . . . German optometrists are planning to build and open a school in Bad Godesberg, about six miles from Bonn, the new capital of the Republic, according to Dr. W. P. Schumann, Vineland, New Jersey. One school now operates in Jena serving the Russian zone for the training of optometrists only. . . . Ohio State's new school of Optometry building is expected to be completed about October 15, 1950. . . . Roy Marks, formerly vice president for sales of Univis Lens Company, has accepted the position of executive vice president and general manager for the public relations and sales directing firm, Lansing Associates. Among the clients of the firm are Soft-Lite and Bay State Optical Co. . . . The Society for Strabismus Research met in Chicago this month. . . . Teenagers will soon be reading Dr. Eugene Freeman's new books, one on Plato and the other on Aristotle. The books will be part of a series written in conjunction with David Appel, book editor of the Philadelphia *Inquirer*, called The Library of Great Ideas. . . . American Optical Company's latest booklets for the profession are "Cataract Lenses and the Aphakic Eye" and "AO Tillyear Ful-Vue Trifocals." The first describes the AO line of precision ground cataract lenses; the second discusses the advantages of trifocals. . . . The Florida Optometric Association has launched a state-wide public information program, designed to inform the public about sight conservation, eye care and professional optometry.

BOOK REVIEW

PRACTICAL ORTHOPTICS IN THE TREATMENT OF SQUINT. T. Keith Lyle and Sylvia Jackson. 3rd Edition. H. K. Lewis & Co., Ltd., London. 271 pages. Illustrated. Cloth. 1949.

T. Keith Lyle is a prominent British ophthalmologist who holds many important hospital posts and is a consultant in ophthalmology for the Royal Air Force. Sylvia Jackson who collaborated in the writing of the first two editions of the test was, until recently, senior orthoptist in the Royal Westminster Ophthalmic Hospital. The first edition of *Practical Orthoptics* was published in 1937 and the authors have been actively engaged in the practice of orthoptics for many years.

As the title suggests, this work on clinical orthoptics has been written from a practical point of view. Theoretical considerations are presented very briefly. There is an interesting and brief historical review of orthoptic treatment touching upon the early use of the perforated masks recommended by Aegineta, Paré, and Bartisch; monocular occlusion suggested by Buffon; Wheatstone's invention of the stereoscope and Javal's extensive use of it. Donders is credited with pointing out the relationship of accommodation and convergence; and, the more recent influence of Maddox, father and daughter, and the contributions of Chavasse, Cantonnet and Fillozat is acknowledged.

The classification and etiology of squint is a condensed version of that portion of Chavasse's work on the subject. The authors stress the desirability of adequate diagnosis before treatment is undertaken and they urge the necessity for the restoration of comfortable binocular vision as early as possible. The chief value of orthoptic training is "... to educate, or more usually to re-educate, the patient to develop his power and range of binocular vision." It is admitted that orthoptic training alone may not always correct the angle of squint but that surgical means may also be necessary. However, it is stated that surgical treatment of strabismus is unsatisfactory without the assistance of a detailed orthoptic investigation. The discussion of the various grades or levels of binocular vision and the development thereof is terse and clear. Anomalous projection is described quite adequately but the treatment suggested is very limited. There are many useful techniques in dealing with anomalous projection which are not discussed. Diagnosis in squint and treatment (optical, orthoptic, and surgical) are presented quite completely. Heterophoria and paralytic strabismus, both congenital and acquited, complete the volume. Essentially, this

new edition of *Practical Orthoptics* differs from the earlier ones in that heterophoria and paralytic strabismus are discussed at greater length, and also by virtue of the addition of instructive case records.

The book is profusely illustrated with pictures of instruments (mostly British-made), diagrams, stereoscopic cards, types of occluders and photographs of patients showing various typical anomalous deviations in the different diagnostic directions of gaze. Numerous case histories with a detailed account of the histories, findings, diagnoses, treatments are included.

At the back of the book is a helpful Glossary containing derivations and definitions of commonly used terms. A remarkably brief bibliography contains only 16 references. Appendix I presents the standards for the discharge of patients as orthoptically satisfactory. Relief of symptoms with single binocular vision for distance and near with good visual acuity and adequate fusional reserves are the chief requisites. Appendix II contains a description of new instruments for the investigation and treatment of binocular anomalies particularly, the Lyle Synoptophore and the Synoptiscope. Finally, there is a comprehensive index which facilitates the location of the page numbers of various topics and their subdivisions.

R. E. BANNON

ABSTRACT

THERAPEUTIC RESULTS IN ADVANCED CHRONIC SIMPLE GLAUCOMA WITH TELESCOPIC FIELDS. Sylvan Bloomfield and Leo Kellerman. (New York, New York). Am. J. Ophth., 32 (9), 1177-1182, September, 1949.

As a result of a study of 41 cases, this paper questions the advisability of surgery in advanced chronic simple glaucoma that is medically uncontrolled. A series of unoperated eyes with central fields reduced in all isopters to 10 degrees or less at the widest meridian were measured on a tangent screen with standard-sized objects. The visual acuity of none was less than 20/200 and all had tensions of over 35 mm. Hg (Schiotz).

Out of the 41 cases, 19 were operated on to relieve tension which could not be lessened by miotic therapy. These 19 eyes had visual acuity of 20/30 to 20/200, 11 of which were over 20/70 and 8, 20/70 or less. Among the 22 unoperated eyes, with visual acuity of 20/30 to 20/200, 11 had visual acuity of 20/70 or better, and 11, 20/70 or less. Tensions were, likewise, similar in all eyes.

Only the results following the first operation were considered in this study, with an average follow-up period of a little over two years. 58 per cent of the operated eyes showed a satisfactory control of tension while 42 per cent remained uncontrolled even with medical treatment. 84 per cent of the entire group showed some loss of visual acuity after operation: 47 per cent to less than 20/200.

The unoperated group were observed in the same average follow-up period of a little over two years, and showed only a 36 per cent loss of vision. In only 14 per cent did the visual acuity go below 20/200.

Nine out of 19 operated eyes showed kidney-shaped fields rather than round fields

with 5 having better than 20/70 visual acuity. Vision was reduced to less than 20/200 in 44 per cent of this group after operation. Among the medically treated group, 8 out of 22 showed kidney-shaped fields, and only 38 per cent showed further reduction of visual acuity (only one went below 20/200).

The authors state that this study would indicate that in the majority of cases of advanced chronic simple glaucoma, surgery would seem to be contraindicated, because useful vision is retained in the central field even though tension is not decreased by miotics.

R. E. B.

THE EFFECT OF A SIMPLE GROUP TRAINING METHOD UPON MYOPIA AND VISUAL ACUITY. A. E. Sloane, E. B. Dunphy, W. V. Emmons (Mass. Eye and Ear Infirmary) and J. R. Gallagher (Phillips Academy). Research Quarterly, 19 (2), 111-117, May, 1948.

The purpose of this study was to investigate the effect upon visual acuity and degree of myopia of a training procedure designed to be inexpensive and which should make but small demands upon an individual's time. The study was conducted at a boys' boarding school and the training was done in groups, rather than individually. The training was supervised by an optometrist but carried out by a technician who had had no previous experience with this type of work.

The authors appreciated that their results might be criticized by those who feel that myopia and/or visual acuity is susceptible to improvement. However, the purpose of this study was not to investigate the effects of ideal visual training methods but simply to make a preliminary investigation of a single simple method of visual training.

The subjects were 10 boys ages 14 to 18 years, who expressed a desire to reduce their myopia and/or improve their uncorrected vision. Their myopia ranged from 0.50 D. to 3.00 D. and there was no anisometropic correction greater than 0.50 D. The preliminary and final refractive examinations were made by two ophthalmologists and one optometrist. A cycloplegic was not used. Training sessions lasted one half hour for a total of 12 weeks.

The only instrument used was a three-dimensional tachistoscope and slides known as the "Form Training Series" and "Digit Training Series" were used. During the courses of the study, the subjects were permitted to wear their corrections.

In general, there was no significant difference in an individual's uncorrected vision following training as judged by two different Snellen charts. In two subjects, there was an improvement of "one line" in each eye after training and in one other subject there was an improvement of "one line" in one eye. However, the authors concluded that these changes seemed hardly beyond the limits of error inherent in the visual acuity tests. In no instance was a change of more than "one line" found.

Retinoscopic examinations after training did not indicate a decrease in myopia in the case of any one of the subjects.

The authors suggest that further similar studies be made and a simple, inexpensive method, requiring little of the trainee's time, be developed if visual training is to be of widespread value as part of a national fitness program.

R. E. B.

FUSIONAL VERGENCE. Edwin Forbes Tait, (Dept. of Ophth., Temple Univ. Med. Sch.). Am. J. Ophth., 32 (9), 1223-1230, Sept. 1949.

This paper presents the results of a study on the stimulus-response mechanism in ocular vergences. An attempt is made to determine the normal distribution of values of the lateral vergence reflexes under certain rigidly controlled conditions.

The subjects were 500 patients taken at random from a much larger group who had clear, comfortable, and efficient binocular vision with suitable glasses. Subjects having more than 2Δ of esophoria or exophoria were excluded. The fixation object used during the tests was a 6/30 letter, black on translucent base, illuminated from behind with an illumination equal to 10 foot candles at the plane of the letter. Risley prisms in a standard phorometer supplied the base-in and base-out prism values which

were introduced before each eye simultaneously at a speed of about 4Δ per second. The prism value coincident with the blurring of the target was not noted, but the prism value just before diplopia was recorded. Once diplopia was reported, the prism power was reduced until fusion was regained and the prism value at this point was recorded. The tests were repeated at least three times and the results reported are the average of these repeated trials. The author states that: "It was rare, however, for the several trials to vary more than 2Δ: in other words, the tests are satisfactorily repeatable."

Tables (1) and (2) show that in the 500 subjects studied, the majority did not maintain fusion under increased prism convergence beyond 30Δ. Only 10 per cent were able to hold fusion at 26Δ and 28Δ convergence. The midpoint range for convergence was found to be between 18Δ and 20Δ. One-half of the subjects maintained fusion in this range. In the divergence tests, 50 per cent of the subjects did not maintain fusion up to 12Δ to 14Δ. Only 10 per cent could see singly at 18Δ to 20Δ, and a very few to 22Δ to 24Δ.

Slow reduction of prism until fusion could reoccur following diplopia, demonstrated that in prism convergence, 10 per cent regained fusion between 10Δ to 12Δ; and 100 per cent between 2Δ and 4Δ. The extramacular fusion area is smaller in divergence tests. Only 20 per cent regained fusion between 5Δ and 8Δ; 50 per cent between 4Δ and 6Δ; and 30 per cent between 2Δ and 4Δ.

These results indicate that vergence functions are the result of reflex conditioning met in any learning process. Further study is concerned with the range of modifications in the position of the visual axes of the two eyes resulting from the effort of the individual to hold or gain single binocular vision. The data derived from these tests help to plot, for a given individual, the retinal area, called the extramacular fusion area, on which images must fall for single binocular vision. If a clinician has this knowledge of distribution and characteristics in normal cases, then abnormal cases can be studied more readily to discover faulty stimulus-response systems. These may then be corrected by stimulating appropriate reflexes through appropriate exercises or other corrective procedure.

R. E. B.

THE COEFFICIENT OF SPECIFIC RESOLUTION OF THE HUMAN EYE FOR FOUCAULT TEST OBJECTS VIEWED THROUGH CIRCULAR APERTURES. Howard S. Coleman, Madeline F. Coleman, David L. Fridge, and Samuel W. Harding. (Optical Research Laboratory, Univ. of Texas, Austin, Texas.) J. Opt. Soc. Am. 39 (9), 766-770, Sept. 1949.

The authors investigated the ability of the human eye to resolve Foucault test objects (grids of alternate black and white lines of equal width) when artificial pupil size, test object contrast, wave length of illuminant, test object size, and test object shape were experimentally varied. Thirty-two observers of both sexes, with ages varying from 18 to 76 years, were used. Age and sex were found to have no influence on the resolving ability.

Among the specific conclusions drawn from the experiments were these:

1) The minimum angle of resolution occurs for an artificial pupil stop diameter of 2.5 millimeters. A 2.5 mm. artificial pupil somewhat improves the resolution of the human eye.

2) For artificial pupil stops smaller than 0.75 mm. in diameter, diffraction of light seems to be the major factor in reducing resolution, rather than aberration of the eye.

3) Foucault test objects having a larger number of elements are more easily resolved.

4) Illumination of the test targets by green mercury light results in a slightly smaller angle of resolution than by incandescent tungsten filaments.

BERNARD ROSETT.

A LISTING OF NEW TECHNICAL BOOKS RECEIVED

WITH OCCASIONAL BRIEF COMMENT BY THE STAFF

Complete reviews will be presented as space permits

HOW TO BECOME A DOCTOR. George R. Moon, A. B., M. A. Examiner and Recorder, University of Illinois, Colleges of Medicine, Dentistry and Pharmacy. Published by The Blakiston Company, Philadelphia. 131 pages. Illustrated. Cloth. $2. 1949. *A guide to the study of medicine, dentistry, pharmacy, veterinarian medicine, chiropody, optometry and hospital administration.*

OCULAR SIGNS IN SLIT-LAMP MICROSCOPY. James H. Doggart, M. A., M. D. Surgeon Moorfields Eye Hospital, London. Published by the C. V. Mosby Company, St. Louis. 112 pages. Illustrated. 85 color plates. Cloth. $6.75. 1949. *A practical text on slit-lamp microscopy.*

HELP YOURSELF TO BETTER SIGHT. Margaret Darst Corbet. Published by Prentice-Hall, Inc., New York. 218 pages. Illustrated. Cloth. $2.50. 1949. *Prentice-Hall should know better.*

THE PHYSIOLOGY OF THE EYE. Hugh Davson, D. Sc. Honorary Research Associate, University College, London. Published by The Blakiston Company, Philadelphia. 451 pages. 301 Illustrations. Cloth. $7.50. 1949. *A physiologist writes on physiological optics for the student and clinical practitioner.*

CLINICAL ORTHOPTICS. Mary Everist Kramer, Supervisor, The Orthoptic Department, The George Washington University Hospital, Washington, D. C. Published by the C. V. Mosby Company, St. Louis. 475 pages. Illustrated. Cloth. $8. 1949. *A text book for American orthoptists and medical technicians.*

PRACTICAL ORTHOPTICS IN THE TREATMENT OF SQUINT. T. Keith Lyle, M. A., M. D., Surgeon & Medical Officer, Orthoptic Department, Moorfields, London, and Sylvia Jackson, S. R. N., D. B. O., Formerly Senior Orthoptist, Royal Westminster Ophthalmic Hospital, London. Third Edition. Published by H. K. Lewis & Company, 136 Gower St., London, W. C. 1, England. 271 pages. 3 color plates. Illustrated. Cloth. £1:11:6d. 1949. *An abundance of sound teaching in this book with a natural leaning-towards surgery.*

THE OPTOMETRIST'S DICTIONARY. Jerome Frank Slutzky, O.D. Published by the Optometric Press, Inc., 2375 Mayfair Road, Dayton, Ohio. 295 pages. Cloth. $5. 1949. *Pocket size and very compact.*

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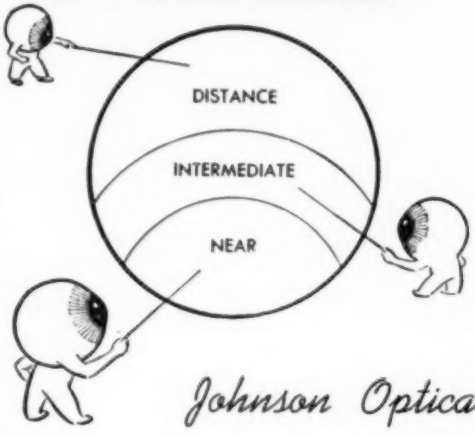

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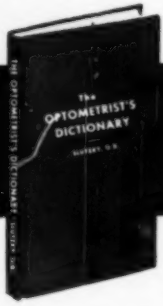

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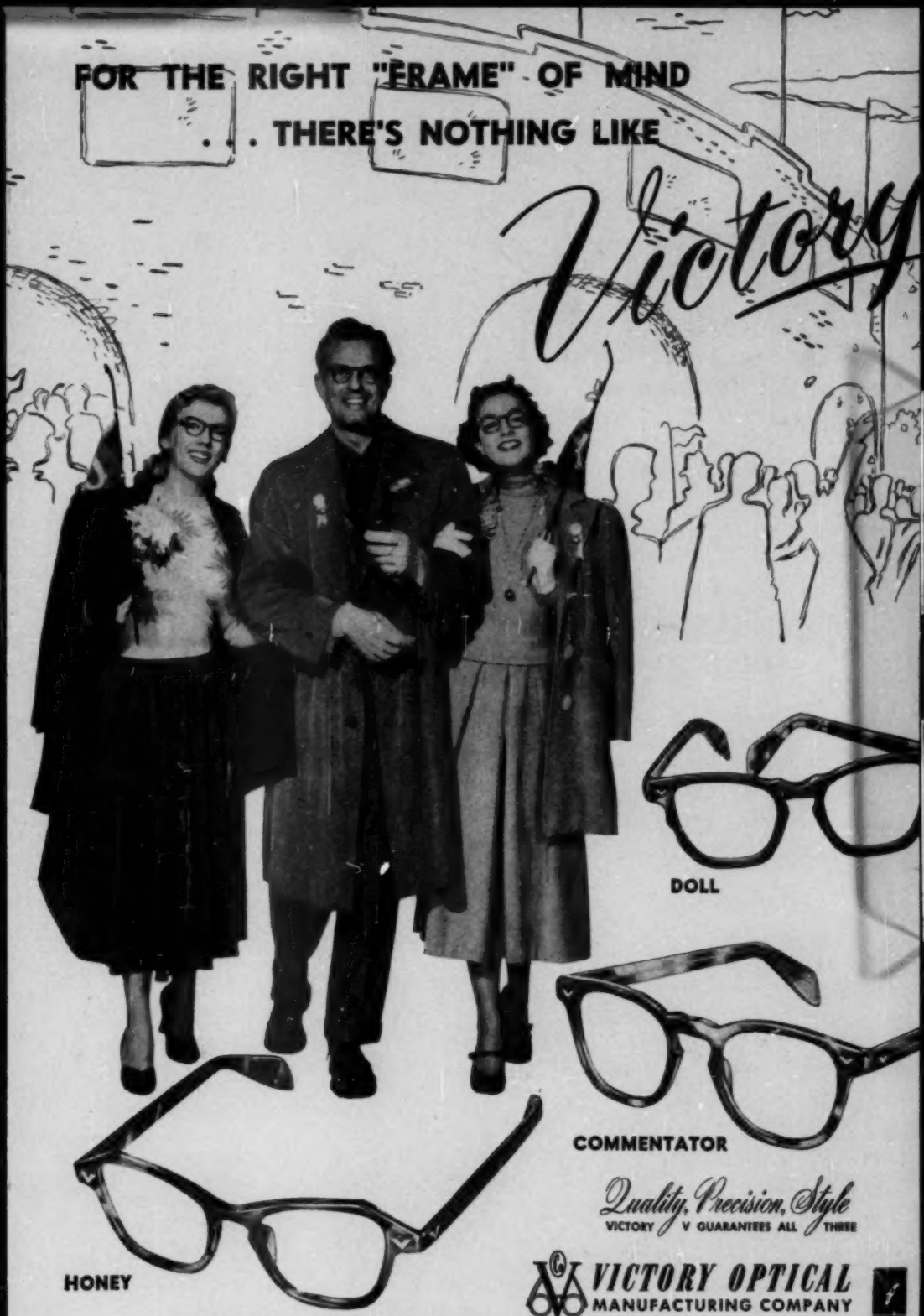

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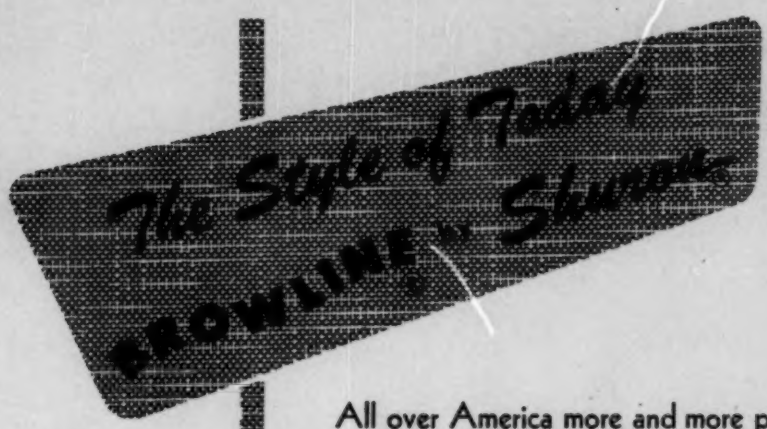

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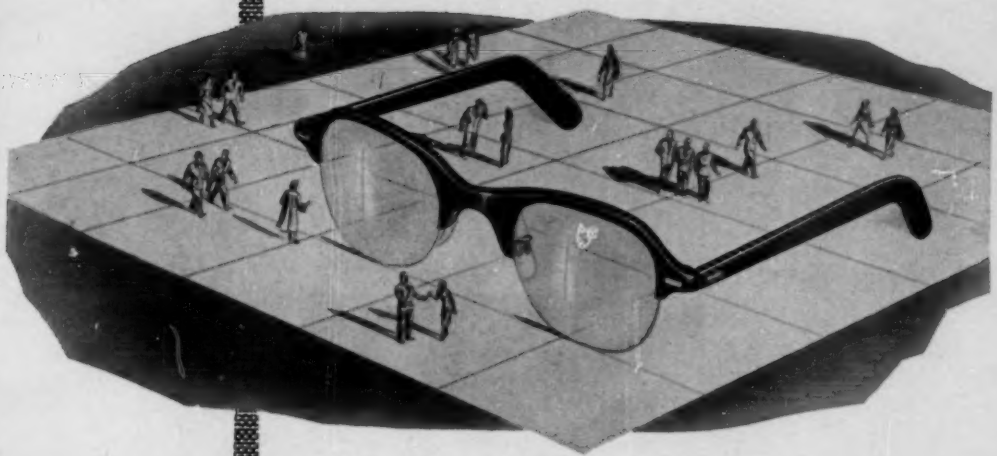

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